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TECHNOLOGY, SIZE, ENVIRONMENT AND STRUCTURE IN NURSING UNITS

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled TECHNOLOGY, SIZE, ENVIRONMENT AND STRUCTURE IN NURSING UNITS submitted by Peggy Leatt in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Sociology.

ABSTRACT

The main purpose of this study was to explore the relationships of technology, size and environment to the structure of nursing subunits in hospitals. In addition, an attempt was made to evaluate the relative importance of technology, size and environment for influencing the degree of structural complexity, formalization and decentralization within nursing subunits. A total of 157 nursing subunits from 24 hospitals in Alberta participated in the research. Data were obtained by interview and questionnaire from nursing administrators, headnurses and nursing staff within each subunit. The results suggested that: 1) there was a tendency for a greater proportion of professional nurses to be employed in small nursing subunits where the technology was unstable and where there was greater need to interact with physicians in the environment; 2) there was greater decentralization in decision-making by the headnurse in subunits where the technology was uncertain, when a greater number of professional nurses were employed in clinical, direct patient care positions and where there were only a few physicians of the same speciality interacting with the subunits; 3) greater independence in decision-making from physicians tended to occur when the technology was more routine and when a large variety of physicians were involved in patient care; and 4) there was a tendency for nursing subunits to use a greater number of written documents when they were located in small hospitals and when clerical staff were employed to process the documents. In general, these findings provided some support for previous research using a contingency approach to organizational analysis.

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TABLE OF CONTENTS

CHAPTER PAGE

CHAPTER PAGE

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The general purpose of this research was to examine the relationship between technology, size, environment and structure in nursing subunits in hospitals. The rationale for the study was derived from the contingency model of organization functioning (see for example: Lawrence and Lorsch, 1967; Perrow, 1970; Thompson, 1967). The contingency perspective has evolved primarily from open systems theory and focusses upon the functioning of an organization within its task environment. The underlying philosophy of the approach is that the nature of an organization's tasks, the size of the organization, the social-political context in which the organization is situated, present each organization with varying sets of contingencies; these contingencies consequently influence the structural form which develops within the organization. One of the long term benefits of contingency research is its potential contribution to organization design. It is assumed that increasing the knowledge of how an organization reaches a state of equilibrium with the contingencies it faces has potential value, in the long term, for designing organizations to augment their effectiveness (Khandwalla, 1977).

Nursing subunits in hospitals were seen as important units for study for four reasons. First, nursing organizations are one particular example of a type of human service organization; it was hoped that by examining the relationships between contingencies and structure in nursing subunits then some contribution could be made to the understanding of other types of human service organizations. Second, there

has been little research, to date, which has examined the relationships between a comprehensive range of contingency variables and structure at the subunit level of analysis. Nursing subunits have the advantage of being clearly identifiable and separable subunits in hospitals which facilitates attempts to maintain consistency in the unit of analysis in research of this type. Third, there has been a general lack of clarity in defining both conceptually and operationally what is meant by the term environment especially for the subunit level in organizations. By using clearly identifiable subunits, such as nursing subunits in hospitals, it was hoped that some clarification could be obtained in the differences in conceptualization and measurement of the environment for the subunit level as opposed to the total organization level. Fourth, nursing departments are responsible for approximately two thirds of the manpower expenditures in hospitals. Accordingly, any information which contributes to the understanding of how nursing subunits function could, in the long term, increase the effectiveness of the health services system.

An Overview of the Contingency Perspective

In recent literature on formal and complex organizations, classical organizational theory has been criticized because it has assumed that the bureaucratic form of organization is applicable to all types of organizations. This traditional approach has suggested that the management of organizations is made easier when all organizations can be structured in the same way regardless of their goals, type of work or place in society. Perrow (1972) maintained that the contingency perspective challenges traditional thinking because it

recognizes that not only may nonbureaucratic forms of organization be more appropriate in some circumstances but that there may be different forms or arrangements at subunit levels within organizations.

In addition, traditional theory has also been found inadequate because it focusses upon organizations as closed systems (Scott, 1975). The open systems perspective evolved in the field of biology in the 1950's and was adopted for use in organizational analysis by researchers such as Katz and Kahn (1966), Thompson (1967) and Baker (1973). Some of the major advantages of the systems approach are that 1) it recognizes that a system exists within an environment which is essential for the system's survival and functioning; and 2) it allows for the possibility of interaction and feedback among components of the system.

According to Thompson (1967), the contingency perspective on organizations views organizations as open systems because it assumes that they are continually faced by uncertainty from multiple conflicting pressures. These pressures may stem from outside the organization, for example, from the social-political environment or from inside the organization, for example, from technological indeterminancies or interpersonal conflicts. Thompson (1967) suggested that organizations, to some extent, have spontaneous self-stabilizing mechanisms which keep them viable in the face of disturbances. Also, since uncertainty tends to be disruptive, organizations generally attempt to control aspects of the environment which are crucial to a balanced state. The contingency model emphasizes that organizations have goals and that they rationally seek out means of achieving their goals in the most expedient manner. Rationality may, however, be less than perfect

because people in organizations, both individually and collectively, have less than perfect skills and judgement (Hall, 1977). For short term goals, organizations are generally viewed as responding entities which have the potential for manipulating their surroundings to their advantage. The actual techniques used by the organization in response to the environment depend considerably upon individual circumstances. In the long term, however, it is recognized that organizations have greater potential for anticipating contingencies and have considerable choice in selecting strategies to their greatest advantage (Child, 1972; Weick, 1969).

In current literature, there are two main groups of contingencies cited as those to which an organization must address itself; these include 1) the characteristics of the environment, and 2) the nature of the technology. The organization's size has also been viewed as an important factor to be taken into consideration in determining organizational structure.

In terms of environmental contingencies, Thompson (1967) indicated that the degree of instability in the environment and the heterogeneity of the elements of the environment were crucial threats to an organization's viability. Thompson (1967) suggested that where the environment is unstable and/or made up of heterogeneous components than an organization tends to seek out the more stabilized aspects of the environment and develops specialized units to handle these; such activities lead to structural differentiation with the organization. In contrast, where the environment is relatively stable and/or made up of homogeneous components then an organization will adapt by establishing standardized rules and regulations for processing the

environmental inputs into the organization.

Lawrence and Lorsch (1967) were some of the first researchers to investigate the effects of environmental contingencies on organizational structure. In a study of 10 organizations from different types of industries, Lawrence and Lorsch (1967) found that, in general, the organizations from the plastic industry faced a task environment with considerable uncertainty and had internal structures characterized by differentiation and complex forms of coordination. In contrast, the organizations from the container industry were faced with little uncertainty from their environments and had less structural differentiation and more standardized forms of coordination.

In general, although there has been much discussion in the literature concerning the potential importance of the environment for determining structural characteristics there has been little research which strongly confirms relationships between environment and structure. Some of the problems in empirical research attempting to examine environment-organization relationships have occurred because of a lack of clarity about the term environment. Typically, environment has been used rather loosely to refer to any factor, physical or social, outside the organization which could potentially affect structure. As such, environment has almost always been used synonomously with external environment. An attempt was made by Duncan (1972) to distinguish between levels of the environment, that is, external (outside the organization) and internal (inside the organization) environments; however, there has been little work done to investigate what meaning these terms might have when the level of analysis is the subunit within organizations.

Woodward's study (1965) of 100 English manufacturing firms was one of the first attempting to evaluate the relationships between the nature of an organization's technology and internal structure. The original intention of this study was to examine whether traditional management principles were observed in business organizations and if these were related to organizational success. No such relationship was found, however, Woodward (1965) made a significant contribution to the development of contingency theory by her findings concerning the relationship between technological complexity and bureaucratization. Woodward (1965) found, for example, that the degree of technological complexity (advancement) in a business firm directly influenced the structure by increasing a) the number of levels of management in the hierarchy, b) the ratio of managers to other categories of workers, c) the ratio of clerical/administrative personnel to other categories of workers, d) the level of education of managers, and e) the ratio of indirect to direct costs of labour. In addition, Woodward's study (1965) indicated that technological advancement led to a general decrease in the proportion of total costs allocated to labour in the firm.

In human service organizations, the most extensive model for examining relationships between technology and structure has been provided by Perrow (1967). Perrow (1967) suggested that the degree of routineness of an organization's tasks was important for the degree of bureaucratization of the internal structure. Specifically, Perrow (1970) indicated that in human service organizations where the technology is likely to be non-routine it is likely that the structure of the organization will be less bureaucratized; for example, there will

be less programming of tasks, fewer rules and regulations, fewer levels in the hierarchy, greater coordination by feedback, greater decentralization in decision-making and a tendency to employ more professionals. Perrow's framework (1967 and 1972) has been used as a basis for much empirical research in human service organizations (see for example: Hage and Aiken, 1967).

Organization size is frequently cited in the literature as the single most important attribute influencing the degree to which structures will be bureaucratized (Child, 1973). This stance stems directly from the Weberian perspective on organizations which suggested that, on the whole, larger organizations tend to be more specialized with more elaborate hierarchical structures, have more rules and regulations and often a greater degree of decentralization in decision-making (Child, 1973). Blau and Schoenherr (1971), for example, based upon an analysis of employment security agencies, argued that size directly influences structural complexity and administrative intensity. These findings have not been confirmed to the same extent by other researchers (see for example: Anderson and Warkov, 1961).

A number of limitations to the current stage of development of the contingency model are apparent from the literature. First, causal relationships are implied between elements of the external environment, technology, size and the internal structure of organizations, however, an adequate model for describing the precise nature of causation between the contingency variables and structure has not yet been developed (Starbuck, 1976). Second, much of the literature to date has focussed upon identifying one or two isolated contingency variables

which may interact with the organization. There has been little attempt even at a hypothetical level to 1) explore the possible interrelationships among elements of the environment, technology and size; and 2) suggest how these variables might combine to influence the internal structure of the organization (Ford and Slocum, 1977). Third, the contingency perspective implies that if an organization is structured appropriately in keeping with the needs as presented by the contingencies it faces then there will be incremental benefits in terms of effectiveness. To date, there has been little consideration of effectiveness variables in contingency research. Exceptions to this have been the investigations of Mohr (1971) and Pennings (1975) but these studies did not confirm that matching structure with contingencies resulted in increases in effectiveness. Such research, however, has been limited by the overwhelming problems of conceptualizing and measuring effectiveness particularly in human service organizations (see for example: Scott, 1978).

A fourth limitation to the stage of development of the contingency perspective is concerned with the level of analysis to which the model is applicable (Hannan and Freeman, 1977). Although most literature discusses the contingency perspective for the level of the total organization there has been a lack of consistency in empirical research in units of analysis. In some instances the total organization has been used, in others the subunits within organizations and in others the individual worker. Not only does this inconsistency reduce the comparability of findings of research but also there is insufficient evidence at this stage to assume that the model is equally applicable to all three levels of analysis. As indicated previously, a particu-

lar problem associated with level of analysis has been the lack of clarity in the conceptualization and measurement of the environment when the unit of analysis is the subunit within organizations.

In conclusion, although the contingency perspective has shown some potential for organizational analysis much more exploratory research is required before a model suitable for providing information for use in organizational design can be developed. As a first step towards more precise specification of a model it is necessary to systematically delineate the range of contingency variables which are relevant to organizations and how these interact with internal structure. It would also seem advantageous to limit investigations initially to one level of analysis and one type of organization so that conceptual clarification can be obtained and the exact nature of relationship between variables can be more precisely delineated.

An Overview of Nursing Subunits in Hospitals

The purpose of this overview is to provide a description of nursing subunits in hospitals within the context of the more general literature on human service organizations.

Human service organizations have been described as having characteristics and problems different from those of other classes of formal organizations (Hasenfeld and English, 1973). First, the raw materials of human service organizations are human beings which come to the organization to be processed or changed in some way (Perrow, 1972). The clients, then, enter the organization with their own cultural values and view the services being provided from their unique perspectives and roles in the larger community. They bring with them their

own desires, motives, attitudes and past learning which influence their expectations concerning how they should be treated and what types of services they should be given (Hasenfeld and English, 1973). The goals of human service organizations are generally defined in terms of the task environment. Each social group having contact with the organization, whether it be clients, the general public, professionals or funding agencies, have their own ideas about what the organization should be trying to achieve. As a consequence, goals are typically ideological and ambiguous; in most cases there will be more than one goal and these may conflicting (Perrow, 1961). The technology of human service organizations is, in general, indeterminant in that there is no clear body of knowledge from which methods of processing the raw materials can be drawn. When techniques are applied there is considerable uncertainty about whether or not the process will be effective and what kind of outcomes may be generated (Thompson, 1967). Because the core technology of human service organizations focusses upon staff-client relationships and attempting to bring about change in human behaviors, the situation is complicated by the personalities and ideologies of both clients and staff (Hasenfeld and English, 1973). In addition, such organizations tend to employ large numbers of professional workers which can produce conflicts between the professional orientations and the functioning of the bureaucracy. Because of the indeterminancy in the technology, however, human service organizations need professionals to reduce uncertainty. Professionals are able to make work more predictable by using a professional ideology and code of ethics to accommodate gaps in knowledge (Friedson, 1973). Finally, as

indicated previously, human service organizations have difficulty defining measures of effectiveness. In general, measures of processes are employed, for example, number of clients seen, as opposed to measures of outcomes, such as, the organization's contribution to the well-being of the community (Scott, 1978).

Acute general hospitals exhibit, to some degree, the same properties as other human service organizations. The main goal of the hospital is to render personalized care and professional treatment to patients. Although this objective may be less ambiguous than the goals of other types of human service organizations, other goals such as those for professional education and research may often interfere with the primary goal. In terms of the technology of the hospital, Georgopoulos (1978) suggested that much of the work cannot be standardized or preplanned because of the individualized nature of patient care. There is little control over workload at a given time because work demands are frequently nondeferrable in the form of emergencies. According to Georgopoulos (1978) the structure of hospitals is complicated by multiple authority lines. The principal workers in hospitals are physicians and nurses. These groups not only have a formal role within the bureaucratic authority structure, which stretches from the chief executive officer to the patient, but they also have a quasi-autonomous line from their profession directly to the patients. In general, health professionals have tended to show greater commitment to their profession than to the bureaucracy (Georgopoulos and Mann, 1962). The structure of hospitals is further complicated by the requirement for health professionals with different backgrounds and skills to work closely together for the common good of patient care.

In general, therefore, there is a high degree of functional interdependence and specialization of tasks. Nevertheless, hospitals cannot function without some degree of compliance to expectations so rules, procedures and role prescriptions exist but these are defined in as flexible a way as possible in order to maximize the professionals' freedom and autonomy.

The external environment, defined as the social-political community in which the hospital is situated, is important for the legitimacy and continuing monitoring of social effectiveness of the hospital. The influence of the external environment may be experienced through responses to hospital activities from the general public, the patient population, individual employees, and other organizations and agencies with which the hospital must interact.

When the level of the nursing subunit within hospitals is examined, it becomes apparent that they are basically small scale representations of the features described for the total hospital and for human service organizations as a whole. The goal of a nursing subunit is to provide personalized and professional nursing care to a group of patients located in a specific geographical area of the hospital. The nursing subunit has little formal control over which patients are admitted to the unit since this is primarily within the decision-making domain of physicians. The patients, however, tend to be located in clusters within nursing units according to their similarities in medical problems; overall this means that they also present similar nursing care problems.

The extent of specialization in nursing technology closely mirrors the degree of specialization in medical technology. For example,

medical, surgical, pediatric, psychiatric and obstetrical subunits exist which reflect subspecialities in medicine. Some of these specialities are now formally recognized in nursing for which postgraduate educational programs have been developed.

The actual tasks performed by nurses may be categorized according to whether they are derived from physicians' directives for patient care or whether they are initiated by nurses independently from physicians (Mauksch, 1966). Those nursing functions stemming from physicians' orders are mainly concerned with attempting to "cure" patients and reduce physiological instabilities. The independent nursing functions are those attempting to "care" for patients by making them feel comfortable, both physically and socio-psychologically. There is no comprehensive or unique body of knowledge for the nurses to draw upon for their independent functions and, as a consequence, the tasks are accompanied by considerable uncertainty (Katz, 1969).

To some degree, nurses function as protectors or advocates for the patients within the subunit. Nurses are responsible for coordinating the activities of paramedical groups and hotel services so that each patient receives the care he requires. If a range of paramedical personnel (e.g., physiotherapist, respiratory technologist, laboratory technologist and Xray technologist) need to have access to a patient at the same time, the headnurse must schedule and control access to the patient so that he/she does not become exhausted by the procedures and so that, in an extreme case, the patient's well-being is not jeopardized (Mauksch, 1966). Although the headnurse of the nursing subunit has no line authority over paramedical and hotel services she is responsible for contacting these departments as directed by physicians

or as she determines they are required; as a result, the nursing subunit tends to be highly dependent upon other groups in the hospital in order to provide patient care yet at the same time must exert some controlling functions over outside groups to protect the patient. To some extent, paramedical and medical groups, hotel and clinical services in the hospital make up the immediate environment of the nursing subunit. Although such groups and subunits are internal to the hospital and, as such, are part of the hospital's internal environment, they are external to the nursing subunit and, therefore, form part of the context in which the nursing subunit must operate.

Each nursing subunit has its own nursing structure comprising at least one headnurse and a range of additional professional and non-professional nurses. A specific complement of nurses is allocated to each unit which the headnurse distributes over the 24 hour period, seven days a week, in order to provide continuous nursing presence on the unit.

It is debated at length in the nursing literature whether or not the occupation of nursing can be considered a "true" profession. Although perhaps aspiring to be professionals and having certain characteristics in common with professionals, it is generally agreed that nurses today do not have sufficient specialized knowledge or autonomy to be considered full professionals. On the whole, nurses are probably more appropriately classified as semi-professionals (Freidson, 1973; Katz, 1969).

There is much genuine concern within nursing subunits about the quality of nursing care being provided and the favorability of outcomes for individual patients. The measurement of effectiveness of

nursing care is problematic because it is almost impossible, within the limits of present methodology, to differentiate between the effects of services provided by nurses from those provided by physicians and other groups. As a result, there is considerable emphasis in the day to day work within nursing subunits on checking, recording and supervising nursing processes to facilitate early detection of errors (Georgopoulos, 1978).

In conclusion, nursing subunits within hospitals can be considered small scale reflections of the characteristics of human service organizations. Each nursing subunit has its own technological domain and social structure. The technology is likely to be indeterminant, that is, characterized by uncertainty, and the structure comprising varying numbers of professionally-oriented nurses and non-professional categories of nurses. The nursing subunit, on the whole, works in close association with physicians and is required to interact with a variety of other hospital workers in order to provide patient care. These groups, which are part of the hospital's internal environment, form important components of the immediate context in which the nursing subunits must operate.

Research Objectives

Given the limitations of the contingency perspective on organizational functioning and the characteristics of nursing subunits in hospitals, the specific research objectives for this study were defined as follows:

1. to examine the relationships between subunit technology and structure in nursing subunits in hospitals;

2. to examine the relationships between subunit environment and structure;
3. to examine the relationships between subunit size and structure;
4. to explore the associations among subunit technology, size environment; and
5. to identify the relative importance of the contingency variables for explaining variance in subunit structure.

In Chapter II, the empirical research examining the relationships between technology, environment, size and structure has been described. Chapter III contains the methodology for the research and in Chapter IV the details of the measurement of variables have been outlined. The results of the study have been presented in Chapters V and VI. In Chapter VII, the findings of the study have been discussed and some conclusions drawn. The final chapter also includes a description of the limitations of the study and some suggestions for further research.

CHAPTER II

EMPIRICAL RESEARCH ON TECHNOLOGY, SIZE, ENVIRONMENT AND STRUCTURE

This chapter describes the empirical research which has examined the relationships between technology, size, environment and structure. The chapter has been divided into five sections. First, a description has been provided of the main approaches used to conceptualize and measure structure. Second, the research attempting to evaluate the relationships between technology and structure has been presented. Third, the studies relating to size and structure have been outlined. Fourth, the investigations measuring organization-environment relationships have been described; and fifth, the research using multivariate approaches to examine contingency effects on structure has been presented. Where possible, particular attention has been given to the discussion of research conducted in human service organizations in general, in hospitals and specifically in nursing subunits.

The Study of Structure

Historically, Weber's concept of bureaucratic authority has been central to both the definition and measurement of the structure of organizations. Weber (1947) indicated that bureaucratic authority derives from the holding of an office and from legitimized rights and duties which are prescribed by an impersonal set of rules. Bureaucratic authority results in a formal hierarchy within the organization which in turn is responsible for distribution of power, resources and information. A major contribution of Weber's concept of bureaucracy was that it outlined a set of structural variables which could be used

as a basis for empirical research.

In contrast to Weber's single concept of bureaucracy, Burns and Stalker (1961) described two bureaucratic forms representing polar extremes; these were called mechanistic and organic management systems. The mechanistic management system represented situations where the work in the organization was divided into specialized tasks, there was a clearly defined hierarchy, rules and regulations, and decision-making was centralized at the top. The organic management system emphasized the importance of the contribution of specialized knowledge. Problem-solving was initiated and decisions made at all levels of the organization. The location of authority was determined by consensus amongst the workers and the leadership style was flexible and adaptable.

In an attempt to empirically define structure, Pugh, Hickson, Hinings and Turner (1968) examined the characteristics of 46 business firms in England. Structure was conceptualized in terms of five variables; specialization; standardization; formalization; centralization; and configuration. Specialization was defined by the division of labor. Standardization referred to the number of rules and regulations. Formalization was defined according to the amount of written documentation. Centralization referred to the location of authority for decision-making; and configuration was defined in terms of the vertical and horizontal divisions in the hierarchy. Data were collected during 1962 to 1964 by interviewing senior executives and reviewing organizational documents. Factor analysis was used to determine the underlying dimensions of structure. From this analysis, 64 scales of structure were reduced to three orthogonal factors; these factors were labelled structuring of activities, concentration of activities and

line control of workflow.

As part of the same study, Pugh, Hickson and Hinings (1969) used multidimensional classification techniques to find out whether the 46 firms could be differentiated into categories by structure. This analysis resulted in the definition of seven types of bureaucracies.

Other researchers have also employed a multidimensional approach to the conceptualization and measurement of structure. Three dimensions, that is, complexity, formalization and centralization, have been the variables most commonly employed.

Structural complexity has been defined as the degree of internal segmentation of the organization as reflected by the horizontal division of labor and the number of vertical levels. This definition was employed by Hall, Haas and Johnson (1967) in a study of 75 organizations of varying types and ranging in size from 6 to 9,000 members. Also, Hage and Aiken (1967), in a study of 16 health and welfare agencies varying in size from 12 to several hundred members, used a similar conceptualization of structural complexity. In this latter study, complexity was specifically defined as the number of occupational specialities, the degree of professional training and the amount of professional activity in the organization. Data were collected in both studies by structured interviews and reviewing records.

The concept of formalization has been used to refer to the degree of standardization in the organization including the degree of specificity of roles, rules and regulations and the extent to which specifications of these are available in written form (Hall, Haas and Johnson, 1967). Hage and Aiken (1967 and 1969) used five measures of formalization; these were job codification, job description, job specificity,

and the use of rule and procedure manuals. Data were collected by questioning individual members in the 16 health and welfare organizations. The participating members were stratified by department and social position. Organizational scores for the variables were calculated by aggregating workers' responses first by social position, then by agency.

Centralization has been defined in terms of the extent to which workers participate in work decisions and the types of decisions they make (Hall, 1963). Hage and Aiken (1967) employed this definition of centralization and measured it by the same methodology they employed for formalization.

Several researchers have acknowledged that the dimensions of structure may not be independent. Hage and Aiken (1967) found a weak relationship between centralization and formalization, a strong relationship between decentralization and complexity and no relationship between complexity and formalization. Hall, Haas and Johnson (1967), however, confirmed some relationships between all three dimensions. Also, Child (1973) in a study of 82 organizations in Britain found that structural complexity was an important predictor of formalization and decentralization.

Pennings (1973) in an investigation of 10 organizations questioned the validity of the measures of centralization and formalization which had been developed by Hickson, Pugh, Hinings and Turner (1968) and by Hage and Aiken (1967). A multitrait multimethod matrix was employed by Pennings to examine the convergent and discriminant validity of the two sets of measures. Although some relationships were found between measures of centralization and formalization using

the same methods there was no convergence of indicators of the same variables using different methods of measurement. In spite of the small sample size in Penning's research (1973) this study demonstrated that findings in relation to structure may be an artifact of the methods employed.

One of the largest studies of hospital bureaucracy was performed by Heydebrand (1973) who examined secondary data for about 7,000 hospitals obtained in 1959 from a routine questionnaire distributed by the American Hospital Association. The main structural dimension examined by Heydebrand (1973) was complexity which was divided in horizontal and vertical aspects. Horizontal complexity was measured by: 1) functional specialization, defined as the number of occupational categories in the hospital; 2) departmental specialization, defined in terms of the size of the medical, nursing, maintenance and administrative components of the hospital; and 3) professionalization, measured by the size of the professional nursing component relative to other employees in the hospital. Vertical complexity was used to refer to the hierarchy of authority and was measured by the supervisor/worker ratio, the administrative/clerical ratio and the degree of bureaucratization of professional nurses (supervisor/professional ratio). This latter variable assumed that the greater the proportion of professionals employed in leadership positions the more bureaucratized the structure.

Although Heydebrand (1973) was able to divide structure complexity of the total hospital into horizontal and vertical aspects, this approach has not been used to measure structure within nursing subunits. Some reasons for this are that: 1) horizontal complexity cannot be

operationalized as the number of occupational categories since there is only one category; and 2) there is little variance in vertical complexity across nursing subunits since there are typically only two levels in the hierarchy (the headnurse position being supervisory over the other subordinate positions).

As one indicator of structural complexity in nursing subunits, Comstock and Scott (1977) measured the ratio of professional nurses to other categories (R.N. ratio) and examined the relationships between this variable and standardization and centralization. The study was conducted in 142 patient care wards (subunits) in 16 acute general hospitals. The subunits were of a variety of types including intensive care, medical, surgical, medical-surgical combined, orthopedic, pediatric, obstetrical and mental health units. Centralization was measured by asking subunit members to estimate, on a five point scale, the extent to which staff nurses, headnurses and other staff could influence decisions about 1) hiring, 2) adding extra staff, 3) disciplining nursing action, and 4) changing nursing care systems. Standardization was measured by asking the nurses how explicit they perceived the procedures governing their own activities. Data were collected by interview and questionnaire. Comstock and Scott (1977) found a positive relationship between complexity and standardization but a negative relationship between complexity and decentralization. The authors interpreted these findings as suggesting that nurses were not as autonomous as other professionals in their work.

In summary, organizational structure has been conceptualized and operationalized in terms of three main dimensions: complexity; formalization; and decentralization. There is some evidence that the

method of measuring dimensions of structure has influenced the nature of results. A causal relationship between complexity and the other dimensions of structure has been implied. In nursing subunits, structural complexity when measured by the R.N. ratio was found to be positively related to standardization and centralization.

Technology and Structure

Although some of the earlier writers in organizational sociology noted the importance of work processes for structure and behavior in organizations (see for example: Dubin, 1958), it was the empirical research of Woodward (1975) which first drew attention to technology as a general determinant of structure. In a study of 100 business firms Woodward described three categories of technological complexity namely, unit batch, mass production, and continuous production. These categories represented the amount of control over the production processes. Woodward (1965) found that organic structures were associated with small unit batch and continuous production technologies and that mechanistic structures were associated with mass production.

Woodward's scale (1965) of technological complexity received considerable criticism concerning the nature of the underlying construct. Starbuck (1965), for example, suggested the dimension referred to smoothness of production, Hunt (1970) implied it was a type of problem-solving and Harvey (1968) used Woodward's scale (1965) to form a measure of technological diffuseness.

Hickson, Pugh and Pheysey (1969) in their study of 46 business firms attempted to evaluate the importance of technology as a predictor of structure. Using a measure of workflow integration developed for

the workflow levels of the organization, Hickson, Pugh and Pheysey (1969) found that technological integration was related to the degree of structuring of activities, departmental specialization and formalization of procedures; however, the results suggested that organizational size was a more important predictor of structure than technology. Aldrich (1972) criticized the analysis performed by Hickson, Pugh and Pheysey (1969) and indicated that size was an intervening variable between the relationship of technology to structure. Also, Aldrich (1972) suggested that some of the importance of technology as a determinant of structure may have been lost because the measure of workflow integration tended to polarize service and business organizations.

Child and Mansfield (1972) in a replication of the work of Hickson, Pugh and Pheysey (1969) in 82 business firms concluded that technology was related to the degree of role specialization and functional specialization, independent from the influences of organizational size.

In studies of human service organizations, the concept of technology most frequently employed has been that outlined by Perrow (1967). As noted in Chapter I, Perrow (1967) described the work performed in organizations according to its routineness. Two conditions were defined as essential for work to be considered routine: first, there must be well established techniques which are sure to work; and second, these must be applied to essentially similar raw materials. In these circumstances, there is little uncertainty about what is to take place and little variety in the tasks to be performed. Perrow maintained (1970) that in human service organizations it is the nature of the raw materials which is important for differentiating organizational types.

The most critical characteristics of the raw materials were seen as, the degree to which they were not understood, their variability, and their instability. For the techniques being applied to change the raw materials, the most important characteristic was the nature of the search processes undertaken to find an appropriate technique. The search process, for example, could be logical and analytic, where techniques could be applied with predictable outcomes. On the other hand, the process could be unanalyzable when outcomes were unpredictable and the search relied upon intuition, inspiration, guesswork, or some similar unstandardized procedure.

Perrow's concept of technology (1967) included not only the hardware and equipment employed in the work but also the thought processes, rationale and ideas behind the use of the techniques. Perrow (1967) stressed the importance of the level of knowledge about both the raw materials and techniques. Where knowledge is adequate then problem analysis and transformation processes can be standardized; however, where a worker perceives the level of knowledge to be inadequate, he will engage in unprogrammed search behavior to find appropriate ways of solving his problem. The importance of workers' perceptions of technology was emphasized by Perrow (1967); he argued that if workers perceive their work as non-routine, whether or not it is routine in an objective sense, then, they will engage in non-standardized behavior to search for satisfactory techniques.

Perrow's concept of technology (1967) has been operationalized in a variety of ways and there has been considerable emphasis placed upon the problems of measuring technology. For example, Grimes, Klein and Shull (1972) developed a measure, which they named task-unit autonomy,

which took into consideration the number of exceptional cases and the analyzability of search behavior. Van de Ven and Delbecq (1974) used two independent dimensions which they called task difficulty and task variability. There has been a trend in the measurement of technology to specialize the instruments to the specific type of organization of interest. For example, for libraries, Lynch (1974) validated a measure of three dimensions: a) the frequency of exceptional cases; b) the nature of search behavior; and c) the level of knowledge available. For health agencies, Mohr (1971) developed a measure of manageability of tasks, and Hage and Aiken (1969) examined the degree of routineness in technology. For nursing subunits in hospitals, Kovner (1966) measured variability in patients and predictability in techniques; Comstock and Scott (1977) used a measure of task and workflow predictability; and Overton, Schneck and Hazlett (1977) developed a measure of technological instability, uncertainty and variability.

In much of the above research, technology was measured by questioning individual workers about their perceptions of their work. For analysis purposes, data from individual workers has been converted to organizational scores by averaging the responses of individual workers in each organization.

There has been considerable research examining the relationship between technology and structure in human service organizations. Hage and Aiken (1969), in their study of health and welfare agencies, found that routine work was associated with centralization and formalization and that agencies with non-routine work employed more professional staff. However, Mohr (1971) in a study of 144 work groups in 13 health departments did not find a relationship between the uniformity,

complexity and analyzability of technology and a measure of participatory style of management.

In nursing subunits in hospitals, Kovner (1966) found relationships between variability and predictability in technology and subunit structure although only 8 subunits were included in this investigation. Comstock and Scott (1977) in their study of 142 nursing subunits concluded that task predictability, when measured by nurses' perceptions, was negatively associated with the R.N. ratio and positively associated with centralization and standardization. Work predictability, as indicated by the main type of patients located on each unit, was positively related to standardization and centralization.

In summary, there has been considerable research examining the relationships between technology and structure. In human service organizations, using the concept of technology outlined by Perrow (1967), technological indeterminancy has been found in association with increases in the proportion of professional workers employed and decreases in formalization and centralization.

Size and Structure

In addition to the research investigating relationships between technology, size and structure there has been a longstanding interest in the exclusive influence of size on structure. Size has typically been defined as the number of personnel in an organization. Price (1972) has criticized this limited conceptualization and suggested that size refers to the scale of operations of the organization and should be measured by a number of indicators, such as, total assets, net sales, average wage earners and so on.

The influence of size upon organizations has been investigated

primarily in relation to administrative intensity and structural complexity. In terms of administrative intensity, it has been assumed that increases in size lead to an increase in the coordination and control requirements and thus to larger numbers of administrative positions (Scott, 1975). This assumption was confirmed by Terrien and Mills (1955) in a study of 2081 school districts; however, an inverse relationship between size and administrative intensity was found by Anderson and Warkov (1961) in the investigation of 49 Veterans Administration hospitals.

Blau and Schoenherr (1971) examined the influence of size in 53 employment security agencies. This research showed that size was negatively related to the supervisor/worker ratio and the staff/worker ratio but positively related to the clerical/worker ratio. Blau and Schoenherr (1971), however, concluded that size had a more direct effect upon administrative intensity and a secondary effect upon structural differentiation.

In terms of the relationship between size and complexity, Meyer (1972) found a positive relationship in 194 government finance departments. The results of Hall, Haas and Johnson (1967) were inconclusive. For example, there was a tendency for larger organizations in this study to have more levels in the hierarchy and be more spatially dispersed. Also, larger organizations were more formalized in terms of the specificity of rules and the authority structure; however, no relationships were found between size and a range of other measures of formalization.

There has been little research focussing upon the relationships between size and decentralization. An exception to this is the work

of Child (1973) who found that size was a more important predictor of decentralization than measures of technology and organizational context.

In hospitals, Heydebrand (1973) measured hospital size by the average daily patient census. This measure correlated at about 0.90 with the number of personnel employed in the hospital and was used as the measure of choice in order to retain the number of personnel as independent as possible for use in calculating indicators of structural complexity. In summary, Heydebrand (1973) found that hospital size was positively related to functional and departmental specialization and negatively associated with the size of professional component of the staff, the supervisor/worker ratio, the clerical/worker ratio and the proportion of technical workers employed. In addition, there was a tendency for larger hospitals to employ more salaried physicians and a greater number of paraprofessional groups.

Comstock and Scott (1977) also found a negative relationship between the size of the professional component (R.N. ratio) and the size of the nursing subunit when this latter variable was measured by the number of subunit beds. A positive association was found between size and centralization in this study which was in contrast to the findings of Child (1973) for business organizations. Overall, Comstock and Scott (1977) concluded that the influences of subunit size were less than the influences of technology.

In summary, the empirical research investigating the relationships of size to structure has been inconclusive. At the subunit level in nursing units and in hospitals in general, size has been found to be negatively related to the extent to which professional workers have been employed. In addition, in nursing subunits, size has been found

to be positively related to centralization.

Environment and Structure

Investigations of environment-organization relationships has taken place at two distinct aggregation levels. Focussing upon populations of organizations some research has studied the distribution of varying types of organizations in different environments (see for example: Hannan and Freeman, 1977). At the second level, which is more relevant to this study, the emphasis has been upon the relationship of individual organizations to their immediate task environment. The immediate environment has been conceptualized according to both its complexity and the nature of the dependencies it creates for organizations.

In terms of complexity of the environment, it has been generally assumed that the heterogeneity of components in the environment and their instability create uncertainties for the organization and this leads to a variety of structural accommodations. This assumption was the basis for early work performed by Dill (1958) and Lawrence and Lorsch (1967).

Duncan (1972), in a methodological study, attempted to develop a measure of perceived environmental uncertainty. Using the conceptualizations of the environment described by Lawrence and Lorsch (1967), Duncan (1972) defined indicators of uncertainty for both internal and external environments. For the internal environment, uncertainty was seen as being generated by personnel, functional and staff units and hierarchical levels. For the external environment, sources of uncertainty were delineated in terms of customers, supplies and social-political and technological factors. These indicators were then used

to develop categories of environments according to whether they were simple/complex or static/dynamic. This typology was derived from Emery and Trist (1965). The simple/complex dimension represented the extent to which uncertainty elements were few in number and homogeneous. The static/dynamic dimension referred to the degree of change in environmental components over time. Duncan (1972) collected data in 22 decision units in six organizations by semi-structured interviews. Duncan (1972) concluded that the static/dynamic dimension was more important for generating uncertainty than the simple/complex dimension; however, Downey, Hellriegel and Slocum (1975) replicated the study and found the converse.

Pennings and Tripathi (1978) investigated environment-organization relationships in 40 financial agencies. These researchers hypothesized that where uncertainty was high, a high degree of decentralization, a low level of formalization and frequent lateral communication could be anticipated. The results did not confirm the hypothesis.

Where environment-organization relationships have been conceptualized in terms of interdependences it has been assumed that the environment contains essential resources which the organization needs for survival (Pfeffer and Salancik, 1978; Yuchtman and Seashore, 1967). The organization, although resisting dependency where possible, enters into a series of transactions and bargaining with its environment (Aldrich and Mindlin, 1978).

Aiken and Hage (1968) investigated the extent to which health and welfare agencies develop joint programs (as a measure of interdependence) and the effects of such programs upon organizational structure.

The findings of this study indicated that where joint programs were established and, therefore, there was greater dependence of the agency on its environment, there was a tendency for greater diversity in occupational specialities and greater numbers of professional workers to be employed.

Some researchers have used the concept of organizational autonomy as an indicator of the relative independence of an organization from its environment. Pugh, Hickson, Hinings and Turner (1969) used this approach but their findings were inconclusive. Mindlin and Aldrich (1975) later reanalysed the data from this study and found that organizations which were highly dependent upon their environments were also likely to be less standardized and formalized. Inkson, Pugh and Hickson (1970) included measures of autonomy with centralization in an overall measure of concentration of authority. Autonomy was defined in terms of 23 types of decisions made by the organization; these related to decisions about personnel management, new products or services, marketing territories, output pricing, and so on. The data were collected in 52 organizations using scheduled interviews with chief executives. The findings suggested that concentration of authority (decreased autonomy) was accompanied by increases in structuring of activities in the organization.

A third approach closely related to the attempts to measure environment-organization relationships has been that evaluating the influence of a range of organizational context variables upon internal structure. This approach emphasizes the importance of the organization's most proximal environment or surroundings; however, it is difficult to judge with this research whether the characteristics of

the context have actually been measures of the environment or measures of the organization itself. An example of this type of research, is the work of Pugh, Hickson, Hinings and Turner (1969). Seven contextual variables were used as predictors of structure; the organization's origin and history, ownership and control, size and size of parent organization, technology, charter, location and dependence. Origin and history was concerned with whether or not the original organization was personally founded and the number of historical changes in location, services offered and so on. Ownership and control related to whether or not the organization was government or privately owned, the degree of public accountability and the relationship of ownership to management. Size of organization and parent organization was measured by net assets and number of employees. Charter was defined as the goals and ideology. Technology was measured by the degree of workflow integration. The location of the organization was described according to the geographic, cultural and community setting. Dependency referred to the dependency upon the parent organization as well as upon other organizations. The information on the contextual factors was obtained through interviews with senior executives and from records. The results of this study will be discussed in the section of the literature using multivariate approaches; however, this research is noteworthy in this section because of the attempt to examine environment-organization relationships through the use of contextual factors. Similar methodology was also used in subsequent studies by Inkson, Pugh and Hickson (1970) and Hinings and Lee (1971).

Heydebrand (1973) also measured contextual variables in his study of hospital bureaucracy. Heydebrand (1973) included a hierarchy of

three levels of contextual variables which were considered important for influencing internal structure. The first level was concerned with the characteristics of the community in which the hospital was located. At a second level were the potential influences of governments, professional associations and accrediting bodies. The third level was concerned with the ownership and control of the hospital, its size and task structure. Heydebrand (1973) did not investigate the effects of these contextual variables upon the internal structure of nursing subunits.

In summary, the main approaches to the investigation of environment-organization relationships have been through the use of concepts of uncertainty, dependency and organizational context. To date, there has been relatively little research supporting assumptions that the nature of the organization's environment influences internal structure. In addition, there has been almost no research examining environment-organization relationships in human service organizations or specifically in hospitals. No studies addressing the importance of the environment of nursing subunits for subunit structure were found in the literature.

Most of the research on organization-environment relationships has focussed upon the level of analysis of the total organization, conceptualizing and measuring the environment in terms of external factors. A departure from this approach was the research of Duncan (1972) which examined both the external and internal environment of organizations. There has, however, been little work done to clarify either conceptually or operationally what is meant by environment when the unit of analysis is the subunit within organizations. There would

seem to be considerable potential, as suggested by Starbuck (1976) for dividing the environment into a number of concentric levels.

Multivariate Studies

The research reported so far has focussed primarily upon the use of one or two contingency variables to attempt to explain variance in structure. There have been a few studies designed specifically to evaluate the relative importance of a range of technological, environmental and contextual factors for predicting structure. In these studies multiple regression techniques have been employed in order to reduce a series of independent variables to a small group of relevant predictors. This approach was used by Pugh, Hickson, Hinings and Turner (1969). In this study, an attempt was made to predict the degree of structuring of activities, concentration of authority, and line control of workflow using the seven contextual factors outlined in the previous section. The most important predictors of structuring of activities were size, workflow integration and size of the parent organization with a multiple correlation coefficient (R) of 0.76. Concentration of authority was best explained by dependence, location, age, charter, workflow integration and size of parent organization with a multiple R of 0.79. Line control of workflow was predicted by charter, workflow integration and location with a multiple R of 0.59.

A similar technique was used by Child (1973) to examine the relative importance of predictors of structural complexity, formalization, and decentralization. A range of independent variables similar to those of Pugh, Hickson, Hinings and Turner (1969) was employed. Overall, organizational size was found to be the most important pre-

dictor of three different measures of structural complexity. In attempting to explain variance in formalization and decentralization, measures of structural complexity were included with the independent variables as possible predictors. For overall standardization, the most important predictors were role specialization, level of specialist qualifications and size of owning group, explaining 78 percent of the variance. Overall documentation was best explained (67 percent of the variance) by role specialization, level of specialist qualifications and workflow integration. Decentralization was less easy to predict with 45 percent of variance explained by size of the organization, workflow integration and overall documentation. Child (1973) concluded that size was important for explaining variance in structural complexity, but structural complexity, in turn, was an important contributor to formalization and decentralization.

The multivariate studies have been performed in manufacturing and business firms. To date, there does not appear to have been any research attempting to systematically compare the relative importance of a wide range of contingency variables in human service organizations or at the subunit level within organizations.

Conclusions

From this review of the literature it would seem clear that the conceptualization and measurement of technology, environment, size and structure has been approached multidimensionally. In terms of structure, complexity, formalization, and decentralization have been used and these variables have been found to be interrelated. Technology, although often treated as unidimensional in business firms, has been

considered multidimensional in human service organizations. Uncertainty, instability and variability have been viewed as important technological variables in nursing subunits. Organizational size has been frequently measured by the numbers of employees and the size of net assets. In hospital studies the number of beds or patient census have been the measures of choice. The environment of organizations has been conceptualized in terms of complexity, dependency, and a range of contextual factors. In general, the environment of the organization has referred to external rather than internal factors.

Measurement of the variables has been approached in two different ways. In human service organizations the tendency has been to use perceptual data obtained from individual workers' opinions. Organizational scores have been developed by calculating an average for the organization for the variables of interest. In business firms, measurement has been achieved mainly by interviewing senior executives and reviewing documents. There is some evidence to suggest that the two approaches to measurement may produce different results.

The relationships found between the independent variables of technology, size and environment and the dependent variable of structure have sometimes been conflicting. Comparison of research results, however, is limited because of differing methods of measuring variables, units of analysis, and types of organizations studied. Overall, some support has been provided for a direct relationship between technology and structure, especially in human service organizations. Organizational size has been found to be related to administrative intensity, complexity, formalization, and decentralization although the type of relationship has been inconclusive. There is still considerable

ambiguity concerning the associations between measures of the environment and structure. There has been little research focussing upon environment-organization relationships either in hospitals or at the subunit level of analysis. It has been implied, however, from research in business firms at the level of the total organization that organizations with heterogeneous and unstable environments and those which are highly dependent upon their environments are likely to have more complex internal structures, less formalization, and greater decentralization.

Most research has used only a few selected contingency variables to try to explain variance in structure. Exceptions to this are the studies of Pugh, Hickson, Hinings and Turner (1969) and Child (1973). Conclusions from the multivariate research suggested that organizational size was the most important predictor of structural complexity and that this variable in turn, was important for predicting formalization. Decentralization was best explained by organizational size.

Overall, the research on nursing subunits in hospitals has focussed upon the investigation of relationships between technology, size and structure. There does not appear to have been any research attempting to define or explore the environment of nursing subunits or attempting to assess the relative importance of a range of contingency variables for nursing subunit structure. In addition, there has been almost no research investigating linkages between contingency variables, structural variables and performance in nursing subunits.

CHAPTER III

METHODOLOGY

In this chapter, the research method has been outlined. First, the overall research strategy has been explained and definitions of the main concepts and variables have been provided. Second, the central guiding hypotheses for the research have been presented. Third, the sample of nursing subunits participating in the research have been detailed. This section includes a description of the hospitals, the types of nursing subunits and the individual nurses involved in the study. Fourth, the data collection procedure has been outlined.

Research Design

The research design was considered primarily exploratory since no comprehensive model has been developed, to date, for explaining variance in structure at the subunit level within organizations. In addition, there has been little research which has systematically investigated a range of contingency variables in hospitals or in nursing subunits.

The specific research objectives for this study were outlined in Chapter 1.[1] Since the overall aim of the research was to attempt to explain variance in subunit structure then structural dimensions were treated, for the most part, as dependent variables. Independent variables included dimensions of subunit technology, components of the subunit environment and subunit size.

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The research was organized so that first, the separate relationships of technology, environment, and size to structure could be examined, and second, the simultaneous interactions of the contingency variables with structure could be explored in order to identify those which appeared to be most important.

The definitions of the main concepts and variables were as follows.

Definitions of Concepts and Variables

The conceptual and operational definitions were based upon the literature as described in Chapter II.

Structure

Subunit structure was conceptualized in terms of the complexity of the types of positions within the nursing subunit, the formalization of roles, and the degree of decentralization in decision-making.

Structural complexity was operationalized by three indicators: 1) the R.N. ratio; 2) the degree of bureaucratization of professional nurses; and 3) the clerical ratio. The R.N. ratio was used as an indicator of the degree of professionalization of the structure and was defined as the ratio of professional nurses to other (nonprofessional) nurses (Comstock and Scott, 1977). It was assumed that the greater the proportion of professional nurses employed the more complex the structure.

Bureaucratization of professional nurses (Heydebrand, 1973) was defined as the proportion of the professional nurses employed in formal leadership positions. This definition indicated that when only a small proportion of the professional nurses were employed in leadership

positions there was, as a consequence, a large proportion of the professionals working in clinical positions directly with patients. It was assumed that when the majority of the professional nurses were employed in clinical positions there would generally be more colleagial types of interactions amongst the nurses and such arrangements would be structurally more complex. This definition of bureaucratization of professional nurses, therefore, viewed structural complexity in terms of the complexities derived from the need for professionally qualified nurses to work in direct care-giving roles in contrast to the complexities derived from the need for professional nurses to work in bureaucratic coordinative roles.

The clerical ratio was defined as the ratio of clerical staff to other personnel within the subunit. The assumption was made that a more complex structure would be associated with greater needs for information and communication and, consequently, greater division of labor to clerical assistants.

Formalization was defined according to the extent to which the norms of the social system were made explicit (Price, 1972) and was divided into two dimensions: 1) role definition; and 2) role specificity. Role definition was delineated as the degree to which job descriptions, rules, procedures, instructions, and communications were in written form (Inkson, Pugh and Hickson, 1970) and operationalized by the extent to which written documents were available to nurses, including contract of employment, position descriptions, procedure and policy manuals, and so on. Role specificity referred to the degree to which nurses' roles and tasks were defined by rules and regulations (Hage and Aiken, 1967). Role specificity was operationalized as the

degree to which nurses perceived rules and procedures guided nursing practice, record keeping, personnel breaks, and so on.

Decentralization was defined in terms of the degree of influence of individuals in work decisions (Aiken and Hage, 1968) and was operationalized by the extent to which nurses within the subunit were influential in making decisions about patient care. Two types of decisions were identified: 1) those made independently from physicians; and 2) those made independently from the headnurse.

Technology

Technology was defined according to Perrow (1967) in terms of the actions an individual performs upon raw materials, such as objects or persons, with or without the aid of tools, in order to bring about change or modification. This concept of technology included the basic characteristics of the objects or persons to be changed and also the knowledge and/or rationale behind the use of techniques to bring about the changes.

For nursing subunits the persons to be changed were interpreted as the patients admitted to each subunit for treatment or care. Three technological variables were specified: 1) uncertainty; 2) instability; and 3) variability (Kovner, 1966; Overton, Schneck and Hazlett, 1977). Uncertainty was defined as the degree to which there was insufficient knowledge about the raw materials and the probability of success in applying techniques. Operationally, uncertainty was seen as the number of patients with more than one diagnosis and also presenting complex nursing problems; and the extent to which nursing techniques were complex, relied upon intuition and feedback from patients. Instability

was delineated in terms of the unpredictable fluctuations in raw materials and techniques. Instability was operationalized in terms of the number of patients: 1) requiring frequent nursing observation and attendance; 2) requiring highly specialized technical monitoring; and/or 3) who were susceptible to emergencies. Variability was described as the degree to which there were variations amongst raw materials and techniques; this was measured in terms of the variety of health problems presented by patients and the degree to which nursing techniques varied between patients (Overton, Schneck and Hazlett, 1977).

Size

In previous research in business organizations, the main indicator of organizational size has been the number of personnel employed in the organization (Price, 1972). In hospitals, the most frequently used indicator of size has been the number of beds located in the hospital or the patient census (Heydebrand, 1973). Number of hospital beds has been employed in preference to number of personnel in the hospital because the number of beds has been thought to provide a more accurate picture of both the physical size and the workload of the hospital. A limitation to the use of the number of beds as an indicator of hospital size is that it does not provide any information about the occupancy rate or the degree of illness of the patients in the beds - both these factors could fluctuate between subunits and on a day to day basis.

For purposes of this research, nursing subunit size was initially conceptualized by two indicators: 1) the number of beds; and 2) the

number of nursing personnel. These indicators were both in keeping with Price's definition (1972) of size as the scale of operations of the organization. Following initial analysis of the data, number of personnel was dropped as a measure of size because there was little variation in number of personnel across types of nursing subunits (see Chapter IV). This finding reduced the utility of number of personnel as a measure of subunit size. In addition, the number of subunit beds was chosen in preference to the number of personnel in each subunit as the measure of size so that the latter measure could be used independently in the measurement of structural complexity. This technique had also been used by Comstock and Scott (1977) and Heydebrand (1973).

Environment

As indicated in the literature review, most of the definitions of the environment from previous research have focussed upon the external environment of the total organization. Duncan (1972) specifically defined both internal and external environments of organizations but did not clarify how these terms applied to the environment of subunits within organizations.

This current research differed from previous research in that it did not attempt to conceptualize or measure the external environment of the total organization (total hospital). Following suggestions of Starbuck (1976) the subunit environment was conceptualized in terms of concentric levels external to the subunit but not external to the hospital. Accordingly, the environment of the nursing subunit was conceptualized at two levels: the immediate perceived environment and the secondary contextual environment.

The <u>immediate environment</u> was defined in terms of the subunit's perceptions of their interaction with other groups, subunits or departments in the hospital. The range of possible groups and departments with which a nursing subunit could interact in the hospital were identified; these included: medical staff; paramedical staff; hotel service departments; nursing administration; clinical service departments; ambulatory care services; admitting department; emergency and operating rooms; and other nursing subunits. Three dimensions were defined along which the subunit's interaction with other groups could vary. These dimensions were complexity, pervasiveness, and autonomy.

Environmental complexity was defined as the number and heterogeneity of the groups, subunits or departments interacting with the subunit (Lawrence and Lorsch, 1967). Accordingly, complexity was operationalized by the number and heterogeneity of medical, paramedical, clinical, administrative and other services interacting with the subunit.

Environmental pervasiveness was delineated as the degree to which the nursing subunit was perceived to be permeated by the various groups in the subunit's immediate environment. Pervasiveness was operationalized by the frequency of contact with the groups previously listed.

Subunit autonomy was defined as the degree of independence of the subunit in decision-making (Aiken and Hage, 1968; Inkson, Pugh and Hickson, 1970). Autonomy was operationalized by the extent to which the subunit made decisions: 1) independently from nursing administration concerning staffing, budgeting, planning, evaluating, and so on; and 2) independently from physicians regarding patients' treatment and care.

The secondary environment of the nursing subunit was defined as the setting in which the subunit operated. This definition most closely resembled the idea of "context" as described by Pugh, Hickson, Hinings and Turner (1969). The secondary environment was operationalized by characteristics of the hospital as a whole, includings its size, teaching status, type of location, and degree of structural differentiation. Hospital size was defined as the number of hospital beds; teaching status referred to whether or not the hospital was a recognized teaching facility; type of location related to whether or not the hospital was situated in a rural or urban community; and structural differentiation referred to the number of functional departments within the hospital. It was assumed that a large, urban hospital with a high degree of structural differentiation would represent a more complex secondary environment for nursing subunits than small, rural hospitals with little structural differentiation. It was also assumed that teaching hospitals would present a more complex environment for nursing subunits than non-teaching hospitals because: a) teaching hospitals are attempting to pursue goals for teaching and research as well as patient care; and b) teaching hospitals generally are pervaded by large numbers and varieties of students from health occupations which can potentially increase the complexity of subunit operations.

Hypotheses

Using previous research and the author's prior experience in nursing administration as a basis, a number of guiding hypotheses were developed:

1. Complexity, Formalization, and Decentralization

1.1 The greater the complexity in structure the lower the formalization.[1]

1.2 The greater the structural complexity the greater the decentralization (Child, 1973; Hage and Aiken, 1967; Hall, Haas and Johnson, 1967).[2]

1.3 The lower the formalization the greater the decentralization (Hage and Aiken, 1967).

2. Technology and Structure

2.1 High technological uncertainty is associated with high structural complexity, low formalization and high decentralization (Comstock and Scott, 1977; Hage and Aiken, 1969).

2.2 High technological instability is associated with high structural complexity, low formalization and high decentralization (Comstock and Scott, 1977; Hage and Aiken, 1969).

2.3 High technological variability is associated with high structural complexity, low formalization and high decentralization (Comstock and Scott, 1977; Hage and Aiken, 1969).

3. Size and Structure

3.1 The larger the subunit size the lower the structural complexity (Comstock and Scott, 1977; Heydebrand, 1973).

3.2 The larger the subunit size the greater the formalization (Aiken and Hage, 1966; Hall, Haas and Johnson, 1967).

3.3 The larger the subunit size the lower the decentralization (Comstock and Scott, 1973).[3]

4. Environment and Structure

4.1 High complexity in the secondary environment is associated with high structural complexity, low formalization, and high decentralization.

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[1] Child (1973), Comstock and Scott (1977) and Hall, Haas and Johnson (1967) found some evidence to the converse; and Hage and Aiken (1967) found no relationship.

[2] Comstock and Scott (1977) found the converse.

[3] Child (1973) found the converse.

4.2 High subunit autonomy is associated with low structural complexity, high formalization, and low decentralization (Aiken and Hage, 1968; Inkson, Pugh and Hickson, 1970).

4.3 High complexity in the immediate environment is associated with high structural complexity, low formalization, and high decentralization (Lawrence and Lorsch, 1967; Pennings and Tripathi, 1978).

4.4 High pervasiveness of the immediate environment is associated with high structural complexity, low formalization, and high decentralization (Pennings and Tripathi, 1978).

5. Technology, Environment, and Size

5.1 Subunits with technologies which are characterized by instability, uncertainty, and variability are situated in a more complex secondary environment.

5.2 Subunits with technologies which are characterized by instability, uncertainty, and variability are associated with complex and pervasive immediate environments, and have low autonomy.

5.3 Small subunits are characterized by high technological instability, uncertainty and variability.[1]

5.4 Small subunits are located in a more complex secondary environment.

5.5 Small subunits have low autonomy and are associated with complex and pervasive immediate environments.

6. Technology, Size, Environment, and Structure

6.1 High structural complexity is associated with high technological uncertainty, instability, and variability, small subunit size, high complexity of secondary and immediate environment, high pervasiveness of the immediate environment, and low autonomy.

6.2 Size is the most important predictor of structural complexity (Child, 1973).

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[1]The rationale for hypotheses 5.3 to 5.5 was based upon the author's prior observations that nursing subunits with complex nursing technologies (and associated complexities in medical technology) had generally only a small number of patients. These subunits were typically highly specialized, such as intensive care units, and located in large teaching hospitals.

6.3 High formalization is associated with low structural complexity, low technological uncertainty, instability and variability, large subunit size, low complexity in the secondary and immediate environment, low pervasiveness of the immediate environment, and high autonomy.

6.4 Structural complexity is the most important predictor of formalization (Child, 1973).

6.5 High decentralization is associated with high structural complexibility, high technological uncertainty, instability, and variability, small subunit size, high complexity in the secondary and immediate environment, high pervasiveness of the immediate environment, and low autonomy.

6.6 Size is the most important predictor of decentralization (Child (1973)).

Unit of Analysis

The unit of analysis for this research was the nursing subunit. A nursing subunit was defined as a geographic inpatient area of a hospital having an assigned number of beds, its own complement of nursing staff, a shared goal(s), and a formal structure. As such, the subunit could be considered a bounded administrative social unit.

Types of Nursing Subunits

The types of nursing subunits included in the study were those most clearly recognizable as distinct nursing subspecialities; these included:

1. pediatric units (PEDS): treating children under the age of sixteen years with general medical/surgical disorders;
2. obstetrical units (OBS): treating both anti- and post-partum patients but not including delivery room and newborn nurseries;
3. rehabilitation units (REHAB): treating adult patients with mainly physical disabilities requiring an active rehabilitation program;

4. intensive care units (ICU): treating patients with a variety of diagnoses admitted for general and specialized intensive care;
5. auxiliary units (AUX): treating adult chronically ill or aged patients requiring long term care;
6. psychiatric units (PSYCH): treating adult patients requiring active psychiatric treatment;
7. surgical units (SURG): treating adult patients for general surgical procedures but not specialized surgery, such as, cardiac surgery, neurosurgery, orthopedic, or ear, nose, throat and eye surgery;
8. medical units (MED): treating adult patients for general medical disorders;
9. rural units (RURAL): treating patients of all ages with a range of common disorders not requiring highly specialized facilities and located in a hospital in a rural setting.

Sample

Hospitals

Hospitals were selected from a list of 97 accredited (Canadian Hospital Directory, 1977) hospitals in the Province of Alberta. An attempt was made to obtain hospitals from both urban and rural locations and hospitals of a range of sizes and type. It was not possible to randomly select hospitals from all of Alberta because of the potential distances to be travelled for data collection. Consideration was, therefore, given to the location of the hospitals in relation to travel time and resources available for the researchers.

Initially, 35 hospitals were asked to participate. Twenty-nine hospitals agreed to be involved, however, because of possible strike action by nursing personnel in some hospitals only 24 hospitals were finally included. The hospitals were located in the Edmonton area or in central or southern Alberta. Twenty of the hospitals were acute general hospitals, the remaining four were specialized hospitals (two rehabilitation, one psychiatric and one auxiliary hospitals). In terms of ownership, 12 hospitals were owned by the municipalities, five by the Province, two by the federal government and five by religious organizations. The hospitals ranged in size from 37 to 1102 beds; seven hospitals had less than 100 beds; nine hospitals had 100 to 299 beds; five hospitals had 300 to 599 beds; and three hospitals had more than 600 beds. Four of the hospitals were classified as teaching hospitals; these were the three acute general hospitals with greater than 600 beds and one rehabilitation hospital with 366 beds.

The hospitals were located in communities of varying size of population. Nine of the hospitals were in communities of between 1,178 to 6,269 persons. Six hospitals were in communities of between 11,800 to 41,217 persons and nine hospitals were located in the urban centres of Edmonton or Calgary with greater than 400,000 persons. The four teaching hospitals, in addition to being the largest hospitals in the study, were also located in the urban centres. The municipal and religious hospitals were all located in the small communities with the exception of one large municipal hospital located in the city of Edmonton.

Subunits

Subunits within each of the hospitals were included in the study

if they met the descriptions of each type and at the convenience of the nursing administrator of each hospital. A total of 157 subunits participated; 26 medical, 34 surgical, 13 intensive care, 14 rehabilitation, 10 auxiliary, 20 pediatric, 15 psychiatric, 14 obstetrical and 11 rural subunits. The majority of these subunits (132 (84.1%)) were located in acute general hospitals, while 25 subunits (15.9%) were from the specialized hospitals. The distribution of types of subunits by type of hospital is shown in Table 1.

Eighty subunits (51%) were located in teaching hospitals and 77 (49%) subunits were located in nonteaching hospitals. As may be seen in Table 2, there was only one auxiliary unit and no rural subunits located in teaching hospitals.

Individual Nurses

In order to measure some variables, questions were asked of individual nurses within each subunit and their responses aggregated to form subunit scores on each variable. The participating nurses for each subunit were drawn from a list of all the nurses occupying full-time equivalent positions (FTES) within each subunit. The FTES for each subunit varied in its composition of registered nurses[1] to other categories of nurses (R.N. ratio). Although it was not feasible to include all the nurses from each subunit in the study nor to randomly select nurses to participate because of practicalities associated with nurses' shift rotations, an attempt was made to obtain as many nurses

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[1]A registered nurse was defined as a nurse who was eligible for registration in the Province of Alberta and included R.N.s (Registered Nurse) and R.P.N.s (Registered Psychiatric Nurse). The other categories included R.N.A.s (Registered Nursing Assistant) and ward aides.

Table 1

Distribution of Types of Subunits in Types of Hospitals

Types of Subunits	Types of Hospitals					
	Acute General	Rehab.	Chronic.	Peds.	Psych.[a]	Total
MED	26 (100.0)[b]					26 (16.6)
SURG	34 (100.0)					34 (21.7)
ICU	13 (100.0)					13 (8.3)
REHAB	3 (21.4)	10 (71.4)	1 (7.1)			14 (8.9)
AUX	5 (50.0)		5 (50.0)			10 (6.4)
PEDS	18 (90.0)			2 (10.0)		20 (12.7)
PSYCH	8 (53.3)				7 (46.7)	15 (9.6)
OBS	14 (100.0)					14 (8.9)
RURAL	11 (100.0)					11 (7.0)
Total	122 (84.1)	10 (6.4)	6 (3.8)	2 (1.3)	7 (4.5)	157 (100.0)

[a]Classification from Canadian Hospital Directory, 1977.

[b]Numbers in parentheses indicate percentage of subunits of the type located in each type of hospital.

Table 2

Distribution of Types of Subunits in Teaching and Non-Teaching Hospitals

Types of Subunits	Non-Teaching Hospitals	Teaching Hospitals[a]	Total
MED	11 (42.3)	15 (57.7)	26 (16.6)
SURG	12 (35.3)	22 (64.7)	34 (21.7)
ICU	4 (30.8)	9 (69.2)	13 (8.3)
REHAB	2 (14.3)	12 (85.7)	14 (8.9)
AUX	9 (90.0)	1 (10.0)	10 (6.4)
PEDS	10 (50.0)	10 (50.0)	20 (12.7)
PSYCH	10 (66.7)	5 (33.3)	15 (9.6)
OBS	8 (57.1)	6 (42.9)	14 (8.9)
RURAL	11 (100.0)		11 (100.0)
Total	77 (49.0)	80 (51.0)	157 (100.0)

[a]Classification from Canadian Hospital Directory, 1977.

[b]Numbers in parentheses indicate percentage of subunits of the type in teaching and non-teaching hospitals.

as possible on given data collection day(s) while stratifying the participants in keeping with the ratio of R.N.s to other categories of nurses (R.N. ratio) of the FTES for each subunit. This stratification procedure was used because it was suspected that the level of education of individual nurses might bias responses. Accordingly, in order to obtain a subunit score which was representative of all nurses within the subunit it was necessary that the education levels of nurses participating from each subunit be as similar as possible to that of the FTES for each subunit.

The total number of individual nurse respondents was 1265. The range in number of respondents per subunit was from 2 to 23 nurses with a mean number of respondents per subunit of 8.0573 nurses. The participation rate (defined as the number of participants to the number of FTES per subunit) ranged from 0.1526 to 0.7385 with a mean rate of 0.4024. Analysis of variance was performed to examine the extent to which there were differences between the nine types of subunits in their mean participation rates. No significance ($\alpha = 0.05$) differences were found (F. value = 1.158, D.F. = 147, F.prob. = 0.3287). To examine the degree to which the R.N. ratio of the respondents was in keeping with the R.N. ratio of the FTES for each subunit, the correlation between the two ratios was examined. Pearson r between the R.N. ratio of the participants for each subunit and the R.N. ratio of the FTES for each subunit was 0.7479 (n = 147, sig. = 0.001).

As a result of the average participation rate per subunit of 40 percent, the lack of differences between types of subunits in their mean participation rates, and the high correlation between the R.N. ratio of participants and the R.N. ratio of the FTES for each subunit,

it was concluded that the data obtained from individual nurses could be aggregated to form subunit scores of acceptable validity.

Data Collection Procedure

The research instruments were developed and pretested as part of the larger study. Data were collected over a period of six weeks during May-June, 1977. For each nursing subunit, a nursing administrator (n = 24) was interviewed and given a structured form to complete in writing. This person provided information relating to the hospital as a whole, subunit structural complexity, role definition, and size. The headnurse of each subunit (n = 157) was asked in person to complete a questionnaire providing information on the subunit's immediate environment and technology. The individual nurses (n = 1265) from within each of the subunits were asked in person to complete a questionnaire relating to the subunit's technology, role specificity, and decentralization.

Data collection was scheduled for a given day or days convenient to the hospital. All the nurses on duty in each subunit on the data collection days, including those working evening and night shifts, were part of the research.

CHAPTER IV

MEASUREMENT OF STRUCTURE, TECHNOLOGY, SIZE AND ENVIRONMENT

In this chapter, the method of measuring the variables has been described. Detailed information about the number and types of questions employed and the sources of data has been provided. Also, the procedures followed to prepare the data for later use in multivariate analysis have been explained; these techniques were basically of two types: 1) where data were obtained from individual nurses within each subunit, it was necessary to aggregate within subunit responses to form subunit scores; and 2) where several questions were employed as indicators of the same variable, it was necessary to summarize each subunit's responses to groups of questions in order to form single composite measures for each variable.

The degree of reliability and validity of the measures has also been discussed in this chapter. The Alpha reliability coefficient (Bohrnstedt, 1969) was employed to evaluate the internal homogeneity of the composite measures. In addition, the direct relationships between measures of the same concept were examined since it was assumed that, in most instances, measures of the same concept would be correlated. Pearson correlation coefficients were used for this analysis with a level of significance of 0.01.

To assess the validity of the measures, analysis of variance was performed to find out if there were differences between the nine types of subunits in their mean scores on the variables. It was assumed that valid measures of subunit variables, in most instances, could be expected to discriminate between types of subunits. The level of significance employed for the analysis of variance was 0.05. Where

the F. value was found to be significant, the Multiple range test, using the Newman Keuls procedure, was applied to compare all pairs of means of the nine types of subunits for the variable in question. The level of significance used for this procedure was 0.05. The Multiple range test provided information on the ranking and grouping of the types of subunits according to their mean scores upon each variable; these results were compared with the ordering of the types of subunits expected on the basis of practical experience.

The actual questions employed for measuring each variable have been listed as Appendix 1 in the order in which they have been discussed in this chapter.

Structure

Nursing subunit structure was measured by three classes of variables: that is, complexity, formalization, and decentralization.

Complexity

The three indicators of structural complexity were: 1) the R.N. ratio; 2) the degree of bureaucratization of professional nurses; and 3) the clerical ratio. The data for these measures were obtained from the nursing administrators during a structured interview (see Appendix 1, items 1 to 6).

R.N. Ratio. The R.N. ratio for each subunit was calculated by obtaining the ratio of the number of registered nurses to the number of full-time equivalent positions (FTES) for each subunit. The number of registered nurses per subunit ranged from 2.4 to 61 with a mean of 12.222 and standard deviation of 7.449. The number of FTES per subunit ranged from 5.2 to 71 with a mean of 21.353 and a standard deviation of 8.401.

The mean R.N. ratio across all subunits (n = 148) was 0.577; the standard deviation was 0.1915 and the range was from 0.176 to 1.000.

Bureaucratization of Professional Nurses. This variable, defined as the proportion of professional nurses employed in bureaucratic leadership positions, was calculated by obtaining the ratio between the number of nursing leaders and the number of professional nurses for each subunit. The number of nursing leaders per subunit ranged from 1 to 4 across all subunits (n = 148). The mean bureaucratization of professional nurses across all subunits (n = 148) was 0.1705 with a standard deviation of 0.1765 and a range of 0.0030 to 1.0000.

Clerical Ratio. The clerical ratio was calculated by obtaining the ratio of clerical positions to the number of FTES for each subunit. The mean clerical ratio across all subunits (n = 148) was 0.0517, with a standard deviation of 0.0336 and a range from 0.0000 to 0.1429.

Using Pearson correlation coefficients, the relationships between the three complexity measures were examined (Table 3). It was expected that the R.N. ratio and the clerical ratio would be positively related to each other and negatively related to the degree of bureaucratization of professional nurses. As described previously, a high R.N. ratio, high clerical ratio and low bureaucratization of professional nurses combined were assumed to be indicators of high structural complexity. At 0.01 level of significance, the degree of bureaucratization of professional nurses was negatively related to both the R.N. ratio (r = -0.4681) and the clerical ratio (r = -0.3322). These relationships suggested that a high R.N. ratio, high clerical ratio and low bureaucratization of professional nurses were reasonably homogeneous measures of structural complexity.

Table 3

Relationships Among Measures of Structural Complexity

Pearson Correlation Coefficients

	R.N. Ratio	Bureaucratization of Prof. Nurses	Clerical Ratio
R.N. Ratio	1.0000		
Bureaucratization of Prof. Nurses	-0.4681* (148)[a]	1.0000	
Clerical Ratio	0.1822 (148)	-0.3322* (148)	1.0000

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measure.

Analysis of variance was performed to find out if there were differences between the nine types of subunits in terms of their mean scores on the structural complexity measures. F. values were significant for all three measures at the 0.05 level (Table 4). Multiple range tests, using Newman Keuls procedure, were used to examine the grouping of the types of subunits according to their mean scores on the R.N. ratio, bureaucratization of professional nurses, and clerical ratio (Table 5). For the mean R.N. ratio, the types of subunits divided into three groups. Intensive care units were significantly ($\alpha = 0.05$) higher than all other types of subunits in their mean R.N. ratio. Auxiliary and rehabilitation units were significantly lower than other types of subunits in their mean R.N. ratio. For the measure of bureaucratization of professional nurses, auxiliary units were significantly higher than all other types of subunits. The grouping of the subunits by the mean clerical ratio was less clearcut, although auxiliary units appeared significantly lower in mean clerical ratio than all types of subunits except rural units. These findings of differences between the types of subunits in terms of the measures of structural complexity were in keeping with the author's experiences in nursing administration and, thus, provided some indication of the validity of the measures.

Formalization

Role definition and role specificity were used as measures of formalization.

Role Definition. The information on role definition was obtained from the nursing administrator who was asked to complete a checklist indicating whether or not specific documents were available to nurses

Table 4

Analysis of Variance of Differences in Mean R.N. Ratio, Mean Bureaucratization of Professional Nurses and Mean Clerical Ratio by Type of Subunit

	D.F.	Sum of Sq.	Mean Sq.	F.Ratio	F.Prob.
R.N. Ratio:					
Between groups	8	2.923	0.365	20.594	0.000*
Within groups	139	2.466	0.018		
Total	147	5.389			
Bureaucratization of Professional Nurses:					
Between groups	8	1.9246	0.2406	12.587	0.000*
Within groups	139	2.6566	0.0191		
Total	147	4.5812			
Clerical Ratio:					
Between groups	8	0.0392	0.0049	5.376	0.000*
Within groups	139	0.1266	0.0009		
Total	147	0.1657			

*Indicates significant at 0.05 level.

Table 5

Multiple Range Tests for Differences in Mean R.N. Ratio, Mean Bureaucratization of Professional Nurses and Mean Clearical Ratio by Type of Subunit

R.N. Ratio:[a]

AUX	REHAB				
0.278	0.349				
RURAL	PEDS	SURG	MED	OBS	PSYCH
0.531	0.574	0.593	0.613	0.632	0.644
ICU					
0.899					

Bureaucratization of Professional Nurses:

ICU	MED	PEDS	SURG	OBS	RURAL	REHAB	PSYCH
0.1020	0.1179	0.1207	0.1279	0.1316	0.1468	0.1736	0.2393
AUX							
0.5710							

Clerical Ratio:

AUX	RURAL					
0.0107	0.0252					
RURAL	ICU	REHAB	OBS	PSYCH	PEDS	
0.0252	0.0421	0.0435	0.0469	0.0497	0.0576	
ICU	REHAB	OBS	PSYCH	PEDS	SURG	MED
0.0421	0.0435	0.0469	0.0497	0.0576	0.0650	0.0694

[a]Subunits in same boxes indicate differences were not significant at 0.05 level.

in each subunit (items 7a to 7v). The list included 22 types of documents, such as, contract of employment, information booklet, hospital organizational chart, hospital and unit orientation programs, hospital and nursing policy and procedure manuals, instructions for shift work, condition sheets, kardex, and position descriptions for each category of nursing personnel. This list of documents was developed on the basis of the author's previous experience in nursing administration and from a similar list of organizational documents employed by Inkson, Pugh and Hickson (1970).

The responses to items 7a to 7v for each subunit were scored 1 or 0 (positive or negative) according to whether each type of document was available. The total amount of documentation for each subunit was calculated by counting the number of different documents available, i.e., positive responses for each individual unit. The range of responses for the measure of total documentation was 0 to 21 documents. The mean number of documents across all subunits was 15.8333; the standard deviation was 3.3789.

Role Specificity. This variable was operationalized by the degree to which nursing behavior was perceived to be controlled by rules and procedures. In developing the measure of role specificity, questions used by Hage and Aiken (1969) were adapted to be more precisely applicable to nursing subunits. Six questions (items 23, 26, 28, 30, 31 and 32) were employed. These questions were asked of the nurses working within each subunit. The questions consisted of statements about the amount of freedom perceived by the nurses in their work. For each item, the nurses were asked to respond in terms of whether they strongly agreed, agreed, disagreed or strongly disagreed with the statements.

The responses to the questions on role specificity were scored from 1 to 4 according to the extent to which they reflected role specificity. For items 23 and 26 a response of strongly agree received a score of 1. Subunit scores for each of the six items were developed by averaging the within subunit responses for each item. Each subunit's scores on all the six items were then added to form a composite measure of role specificity. The Alpha reliability coefficient was employed to estimate the homogeneity of the six role specificity items; the coefficient was 0.78124. The mean role specificity for all subunits (n = 156) was 16.5946, with a range of scores from 11.0000 to 19.8571 (possible range 6 to 24) and a standard deviation of 1.4031.

Using the Pearson correlation coefficient, the relationship between role definition and role specificity was examined. This procedure indicated that the two indicators of formalization were not significantly related at 0.01 level (r = 0.1252, n = 155, sig. = 0.060).

Analysis of variance was performed to find out if there were differences between the types of subunits in terms of their mean role definition and role specificity. For mean role definition, the F. value was 2.121 (D.F. = 155) with a probability of 0.0372. For mean role specificity, the F. value was 2.015 (D.F. = 155) with a probability of 0.0484; however, when the Multiple range test was used ($\alpha = 0.05$) to examine the grouping of the types of subunits in terms of mean role definition and role specificity, the types of subunits formed only one subset.

On the basis of the author's previous experience it was anticipated that first, the two measures of formalization would be related, and second, that significant differences between the types of subunits would

be found; however, even though the findings from this initial analysis were unexpected, both measures of formalization were retained in the study for use in further analysis because of their importance in the measurement of structure in previous research.

Decentralization

Eight questions, modified from Aiken and Hage (1968), were used to measure the degree of influence of nurses in work decisions. Three questions (items 24, 25 and 27) asked nurses' opinions about their degree of decision-making independent from physicians. Five questions (items 33 to 37) related to nurses' decision-making for nursing care independently from the headnurse. The questions on decentralization were asked of the nurses within each subunit. For each question, the respondents were requested to indicate the extent to which they strongly agreed, agreed, disagreed or strongly disagreed with the statements provided.

The responses to the questions were scored 1 to 4 according to the degree to which they reflected decentralization. For items 24, 27, 35, 36 and 37, a response of strongly agree received a score of 1; for items 25, 33 and 34, a response of strongly agree received a score of 4. Subunit scores for each item were developed by averaging the within subunit responses to each item. The subsequent analysis was then performed on unit scores for each item.

Two composite measures of decentralization were developed: 1) decentralization from physicians; and 2) decentralization from the headnurse. For the measure of decentralization from physicians, a composite score was developed by adding the subunit's scores on items 24,

25 and 27. The Alpha reliability coefficient for combining the scores on these three items was 0.78151. The measure of decentralization from the headnurse was formed by combining scores on items 33 to 37. The Alpha coefficient for this combination was 0.86091.

In terms of the decentralization from physicians, the subunits' scores ranged from 5.2000 to 10.0000 (possible range 3 to 12) with a mean score across all subunits (n = 156) of 7.2903 and a standard deviation of 0.9353. For decentralization from the headnurse, the subunits' scores ranged from 10.7143 to 18.5000 (possible range 5 to 20), with a mean score of 14.4704 (n = 156) and a standard deviation of 1.4555.

Analysis of variance was performed to examine the extent of differences between the types of subunits in terms of the mean decentralization from physicians and the mean decentralization from the headnurse. The results of the F. tests were significant as shown in Table 6. Decentralization from the headnurse divided the types of subunits into three subsets (Table 7); however, the groups were not clearcut. In general, psychiatric and intensive care units appeared higher in their degree of decentralization from the headnurse, whereas, auxiliary and obstetrical units were relatively low. For decentralization from physicians, the Multiple range test divided the types of subunits into two overlapping groups. Intensive care and psychiatric units were relatively low in their decentralization from physicians as shown in Table 7.

These findings suggested that, to some extent, the ordering of the types of subunits were reversed on the two measures of decentralization. This result was also confirmed by a significantly (α = 0.01) high nega-

Table 6

Analysis of Variance of Differences in Mean Decentralization from Physicians and Mean Decentralization from the Headnurse by Type of Subunit

	D.F.	Sum of Sq.	Mean Sq.	F.Ratio	F.Prob.
Decentralization from Physicians:					
Between groups	8	19.7363	2.4670	3.130	0.0027*
Within groups	147	115.8634	0.7882		
Total	155	135.5997			
Decentralization from the Headnurse:					
Between groups	8	70.6641	8.8330	5.039	0.0000*
Within groups	147	257.7020	1.7531		
Total	155	328.3660			

*Indicates significant at 0.05 level.

Table 7

Multiple Range Tests for Differences in Mean Decentralization from Physicians and Mean Decentralization from the Headnurse by Type of Subunit

Decentralization from Physicians:

ICU	PSYCH	SURG	AUX	MED	REHAB	OBS	RURAL
6.7161	6.7376	7.0642	7.3028	7.3364	7.4901	7.5984	7.6635

[a]

AUX	MED	REHAB	OBS	RURAL	PEDS
7.3028	7.3364	7.4901	7.5984	7.6635	7.8243

Decentralization from Headnurse:

OBS	AUX	REHAB	PEDS	SURG	RURAL
13.5059	13.5493	13.7256	13.9228	14.5106	14.6918

AUX	REHAB	PEDS	SURG	RURAL	MED
13.5493	13.7256	13.9228	14.5106	14.6918	14.9290

SURG	RURAL	MED	ICU	PSYCH
14.5106	14.6918	14.9290	15.3560	15.5999

[a]Subunits in same boxes indicate the Multiple range test was not significant at 0.05 level.

tive relationship between the two composite scores of decentralization; the Pearson correlation coefficient (n = 156) was -0.5563. This finding was in keeping with practical experience and suggested reasonable validity for the two measures.

Technology

Technology was measured by 21 questions asked of individual nurses from each subunit. These questions had been used in earlier research on nursing subunit technology and had previously demonstrated a satisfactory degree of validity (Overton, Schneck and Hazlett, 1977). Ten items were used to measure uncertainty (items 3, 4, 9, 10, 11, 12, 13, 16, 17, and 18); eight items were used for instability (items 1, 5, 6, 7, 8, 19, 20, and 21); and three items for variability (items 2, 14, and 15). In most questions the nurses were asked to indicate percentages of patients, tasks or time. The range of possible responses were 0-5, 6-25, 26-50, 57-75, 76-100 percent; the actual responses were converted to a scale of 1 (0-5%) to 5 (76 to 100%). In all questions on uncertainty and instability, a high percentage received a high score. The questions on variability were phrased in terms of similarity of patients and tasks, therefore, a high percentage received a low score. Unit scores for each question on technology were developed by calculating the mean of within subunit responses for each item.

In order to reduce the 21 technology items to form single measures of uncertainty, instability and variability, factor analysis was used. Although a number of different factor analyses were performed the most appropriate solution in terms of theory and proportion of variance accounted for was a three factor oblique solution. The three

factor solution (Table 8) explained 66.5% of the variance in responses to 18 items. Items 18, 19 and 20 were eliminated because of relatively low commonalities (0.370, 0.355, 0.121, respectively). The factor structure was essentially very similar to the one produced in previous research by Overton, Schneck and Hazlett (1977) suggesting considerable reliability for the measures of technology. The three factors were labelled instability, uncertainty, and variability.

The items loading highly on factor 1, instability, were concerned with the unpredictable fluctuations in patients' conditions as reflected by their needs for frequent nursing observation (item 1), requirements for many tests (item 5) and the use of technical equipment (items 6 and 7). Time pressure (item 8) and the emergency nature of the work (item 21) was also reflected. The second factor was concerned with the uncertainty in nursing tasks because of the complex nature of patients' problems and treatment (items 4 and 10), the social-psychological nature of nursing care (item 12) and the extent to which the work changed in response to patients' conditions and moods (item 17). Also, uncertainty was reflected by the nurses' need for a detailed health history (item 3) and written patient care goals (item 11) and by the use of intuition in solving problems (item 13). Both the instability and uncertainty factors were related to nursing work which depended upon the skills and initiative of the nurses and involved solving complex problems. This was reflected by high loadings on both factors by items 9 and 10. The third factor was quite clearly technological variability with items 2, 14 and 15 loading highly on this factor.

The oblique solution indicated that the three factors were interrelated. Factors scores for instability, uncertainty and variability

Table 8

Technology - Oblique Factor Structure Solution

Item	Content	Instability	Uncertainty	Variability
03	Detailed health history	0.295	0.582	-0.099
04	Patients' complex problems	0.311	0.615	0.125
11	Written goals	-0.211	0.511	0.246
12	Social-psychological nursing	-0.166	0.742	0.115
13	Nurses' intuition	0.237	0.802	0.034
17	Patients' conditions and moods	0.494	0.660	0.016
09	Work depends on nursing skills	0.596	0.564	0.057
10	Analysis of complex problems	0.592	0.781	0.081
16	Speciality difficult	0.573	0.362	-0.179
01	Frequent observation	0.691	0.406	-0.159
05	Tests and procedures	0.776	0.158	-0.037
06	Equipment	0.881	0.148	-0.154
07	Intravenous infusions	0.789	-0.052	-0.097
08	Time pressure	0.914	0.181	-0.155
21	Emergencies	0.751	0.269	-0.024
02	Patients' dissimilar	-0.240	-0.091	0.824
14	Care dissimilar	-0.134	0.110	0.928
15	Work nonrepetitive	0.118	0.199	0.645

were derived for each subunit (mean = 0, standard deviation = 1). Pearson correlation coefficients between the factor scores showed that only the relationship between uncertainty and instability was significant at the 0.01 level with a Pearson r of 0.2523 (Table 9).

Analysis of variance was performed to see if there were differences between the mean technological factor scores for each of the nine types of nursing subunits. The results of the analysis of variance are shown in Table 10. The results of the F. test were significant at the 0.05 level for all three factors. The findings from the Multiple range tests are illustrated in Table 11. For instability, the types of subunits divided into three groups. Intensive care units were significantly (α = 0.05) higher than all other units in terms of instability. The rest of the units were divided into two groups; rehabilitation, auxiliary and rural units appeared to be relatively low in instability, whereas psychiatric, pediatric, obstetrical, surgical and medical units were placed in the middle range.

For uncertainty, the psychiatric units were significantly higher than all the other types of subunits. Intensive care units, rehabilitation, pediatric, medical and auxiliary units appeared in the middle for technological uncertainty and obstetrical, surgical and rural units appeared relatively low in uncertainty.

When variability was examined the types of subunits did not differentiate into concise categories. The results of the Multiple range test produced four subsets; however, there was considerable overlap between the types of subunits in each subset. On the whole, it appeared that obstetrics, intensive care and auxiliary units had relatively low technological variability and medicine, pediatric, psychiatric, rehabil-

Table 9

Relationships Among Measures of Technology

Pearson Correlation Coefficients

	Instability	Uncertainty	Variability
Instability	1.0000		
Uncertainty	0.2523* (156)[a]	1.0000	
Variability	-0.1328 (156)	0.1029 (156)	1.0000

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

Table 10

Analysis of Variance of Differences in Mean Technological Instability, Uncertainty and Variability by Type of Subunit

	D.F.	Sum of Sq.	Mean Sq.	F. Ratio	F. Prob.
Instability:					
Between groups	8	90.828	11.354	29.721	0.000*
Within groups	147	56.155	0.382		
Total	155	146.984			
Uncertainty:					
Between groups	8	77.964	9.746	22.861	0.000*
Within groups	147	62.664	0.426		
Total	155	140.628			
Variability:					
Between groups	8	43.576	5.447	8.235	0.000*
Within groups	147	97.229	0.661		
Total	155	140.805			

*Indicates significant at 0.05 level.

Table 11

Multiple Range Tests for Differences in Mean Technological Instability, Uncertainty and Variability by Type of Subunit

Instability:[a]

REHAB	AUX	RURAL	PSYCH	PEDS	OBS
-0.766	-0.734	-0.580	-0.400	-0.251	-0.139

PSYCH	PEDS	OBS	SURG	MED
-0.400	-0.251	-0.139	0.110	0.150

ICU
2.298

Uncertainty:

OBS	SURG	RURAL	AUX	MED	PEDS	REHAB
-0.654	-0.544	-0.461	-0.136	-0.106	-0.014	0.001

AUX	MED	PEDS	REHAB	ICU
-0.136	-0.106	-0.014	0.001	0.609

PSYCH
1.908

Variability:

OBS	ICU	AUX
-1.309	-0.644	-0.614

ICU	AUX	SURG	RURAL
-0.644	-0.614	0.137	0.207

AUX	SURG	RURAL	REHAB	PSYCH
-0.614	0.137	0.207	0.239	0.304

SURG	RURAL	REHAB	PSYCH	PEDS	MED
0.137	0.207	0.239	0.304	0.386	0.401

[a]Subunits in the same boxes indicate the differences were not significant at 0.05 level.

itation, rural and surgical units had slightly greater variability although no clear conclusions could be drawn.

As an additional predictive validity check upon the measure of instability, the relationship was examined between the instability factor scores and the headnurses' responses to a single question (item 107) concerning the amount of complex equipment utilized. It was expected that high instability in patients and techniques would be associated with high use of complex equipment. The Pearson correlation coefficient between the two measures was 0.4104 (n = 156, sig. = 0.001).

Overall, the findings of differences between the types of subunits in terms of technology and the additional validity check for the measure of instability were in keeping with previous research by Overton, Schneck and Hazlett (1977). Accordingly, the measures of technology were considered sufficiently reliable and valid for further use.[1]

Size

The information on the number of beds for each subunit was obtained from the nursing administrator. The number of beds per subunit (n = 156) ranged from 3 to 75 with a mean of 30.603 beds. The Pearson

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[1] In keeping with methodology suggested by Alwin (1973), composite scores for instability, uncertainty, and variability were calculated by adding together the responses to items with high loadings within each factor. Instability was constructed from items 1, 5, 6, 7, 8, 9, 16, 21; uncertainty from items 3, 4, 10, 11, 12, 13, 17; and variability from 2, 14 and 15. The Alpha coefficients for these scales were 0.90275, 0.81976, and 0.81678, respectively. The correlation between the composite scores and respective factor scores for each dimension of technology produced Pearson correlation coefficients of at least 0.97 between each pair. Although the composite scores would have appeared to be as equally valid as the factor scores, the factor scores were preferred because they provided marginally better explanation of variance in structural variables in later analysis.

correlation coefficient between number of beds per subunit and number of FTES per subunit was 0.444 (n = 148, sig. = 0.001). This correlation was considerably less than the relationship found at the level of the total hospital by other researchers. For example, Heydebrand (1973) found a correlation of about 0.9 between number of hospital beds and number of personnel. The relatively low relationship found at the subunit level, in this study, suggested that number of beds and number of FTES were not indicators of the same aspects of subunit size.

Analysis of variance was used to examine the extent of differences between the types of subunits in the mean number of beds (Table 12). The results of this analysis were significant and the Multiple range test showed that the types of subunits were grouped into three distinct categories. Intensive care units were significantly smaller than all other types of subunits and auxiliary units were significantly larger than all other types of subunits (Table 13). These findings were in keeping with what could be expected. Analysis of variance was also used to examine the extent of differences between the types of subunits in terms of mean number of FTES; however, no significant differences were found at the 0.05 level; this finding provided further support for number of beds being used as the measure of subunit size of choice.

Environment

The measurement of subunit environment was divided into two levels: first, the more distant, secondary environment, interpreted in terms of characteristics of the total hospital; and second, the immediate environment measured in terms of the subunit's perceived relationships with other groups, subunits and departments within the hospital.

Table 12

Analysis of Variance of Differences in Mean

Subunit Size by Type of Subunit

	D.F.	Sum of Sq.	Mean Sq.	F. Ratio	F. Prob.
Number of Beds:					
Between groups	8	10175.740	1271.967	13.700	0.0000*
Within groups	147	13647.619	92.841		
Total	155	23823.359			
Number of FTES:					
Between groups	8	1003.440	125.430	1.860	0.071
Within groups	139	9371.829	67.423		
Total	147	10375.269			

*Indicates significant at 0.05 level.

Table 13

Multiple Range Test for Differences in Mean

Subunit Size by Type of Subunit

ICU 15.154						
OBS 27.615	PSYCH 27.933	REHAB 28.143	PEDS 30.500	RURAL 30.636	MED 31.231	SURG 31.794 [a]
AUX 56.500						

[a]Subunits in same boxes indicate the differences were not significant at 0.05 level.

Secondary Environment

The information about the characteristics of the total hospital was obtained from the Canadian Hospital Directory (1977). Since there were only 24 hospitals in the study, subunit scores had to be generated from hospital scores. As a consequence, subunits (n = 157) were given the same scores on each variable if they were located in the same hospital. The range in number of subunits per hospital was from 1 to 40. Four hospital characteristics represented the complexity of the secondary environment; these were number of beds, structural differentiation, type of location, and teaching status of the hospital.

The range in number of hospital beds was from 35 to 1102 with a mean number of hospital beds of 575.5 and a standard deviation of 401.1. The number of hospital beds was highly related to the total number of personnel in the hospital and the size of the annual budget with Pearson correlation coefficients of greater than 0.97 amongst the three variables.

As indicated in Chapter III approximately half the subunits were located in teaching hospitals and half in non-teaching hospitals. The distribution of each type of subunit in teaching and non-teaching hospitals was shown in Table 2. As was noted earlier there was only one auxiliary unit and no rural units located in teaching hospitals. These findings were to be expected.

Hospital structural differentiation was measured by counting the number of positions listed as "director" in the Canadian Hospital Directory (1977) for each of the hospitals. The mean number of directors for the 24 hospitals was 13.9742 with a standard deviation of 4.8989. The range in number of directors was from 2 to 21.

The fourth measure of the secondary environment related to the type of location of the hospital. This measure was operationalized by the relative size of the population of the community where the hospital was located (Census of Canada, 1971). Because of the wide variation in the population sizes of the communities where the hospitals were located, raw population scores could not be employed. Consequently, a scale of community size was constructed ranging from 1 to 3. Small communities, receiving a score of 1, were those with less than 7,000 persons; intermediate communities were those with a population size of 11,000 to 50,000, receiving a score of 2; large communities were those with more than 400,000 persons (Edmonton and Calgary) receiving a score of 3. The 24 hospitals were classified on the scale of community size from 1 to 3. The mean score of the hospitals on this scale was 2.5290 with a standard deviation of 0.67720.

The relationships between the 4 measures of the secondary environment are shown in Table 14. Even though teaching status of the hospital was a dichotomous variable, Pearson correlation coefficients were considered appropriate measures of relationships amongst the four secondary environment variables; Hinkle, Wiersma and Jurs (1979) have indicated that the biserial and Pearson correlation coefficients obtain the same results in measuring relationships between a dichotomous and an interval level of measurement variable. Although the Pearson correlation coefficients among the secondary environment variables were relatively high (Table 14), because of the exploratory nature of the research, the four measures were judged sufficiently independent to be used in further analysis.

Table 14

Relationships Among Measures of Secondary Environment

	Hospital Size	Teaching Status	Structural Differentiation	Community Size
Hospital Size	1.0000			
Teaching Status	0.8686* (157)[a]	1.0000		
Structural Differentiation	0.7872* (157)	0.7477* (157)	1.0000	
Community Size	0.6933* (157)	0.7045* (157)	0.7412* (157)	1.0000

*Indicated significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits for which data were available.

Analysis of variance was performed to examine the extent to which there were differences between the types of subunits in terms of their mean scores on three measures of the secondary environment: hospital size, structural differentiation and community size. Table 15 illustrates that F. values for all three measures were significant. The results of the Multiple range tests for the three variables are shown in Table 16. With respect to mean hospital size and mean community size the types of subunits formed only one group indicating that, with a level of significance of 0.05, there were no differences between the types of subunits. For mean structural differentiation, the types of subunits were divided into two groups although the categories were not clearcut. Rural and auxiliary units appeared to be located in hospitals with lower structural differentiation and intensive care, pediatric, surgery and obstetrical units appeared to be located in hospitals with greater structural differentiation. Rehabilitation and psychiatric units appeared to be located in hospitals with moderate structural differentiation. The lack of clearcut differences between the types of subunits in terms of their scores on the three measures of secondary environment was not unexpected because of the lack of systematic control of these variables when selecting hospitals and subunits for inclusion in the study.

Immediate Environment

The immediate environment of the nursing subunit was specified by three dimensions: autonomy, complexity and pervasiveness. The data for the measurement of the immediate environment were obtained through each headnurse's perceptions of her subunit's interactions with other groups, subunits and departments within the hospital.

Table 15

Analysis of Variance of Differences in Hospital Mean Size, Mean Structural Differentiation and Mean Community Size by Type of Subunit

	D.F.	Sum of Sq.	Mean Sq.	F.Ratio	F.Prob.
Hospital Size:					
Between groups	8	5336785.7128	667098.1875	4.973	0.0000*
Within groups	148	19851702.1694	134133.0625		
Total	156	25188480.0000			
Structural Differentiation:					
Between groups	8	1656.8955	207.119	14.618	0.0000*
Within groups	148	2096.8640	14.1680		
Total	156	3753.7595			
Community Size:					
Between groups	8	30.6139	3.8267	14.004	0.0000*
Within groups	148	40.4434	0.2733		
Total	156	71.0573			

*Indicates significant at 0.05 level.

Table 16

Multiple Range Tests for Differences in Hospital Mean Size, Mean Structural Differentiation and Mean Community Size by Type of Subunit

Hospital Size:

RURAL 55.3636	AUX 361.8999	REHAB 442.9285	OBS 537.4285	PEDS 572.3499
PSYCH 627.1333	MED 667.5383	SURG 737.7056	ICU 769.3076	

[a]

Structural Differentiation:

RURAL 4.1818	AUX 10.0000	REHAB 12.0000	PSYCH 13.1333

REHAB 12.0000	PSYCH 13.1333	OBS 15.0000	MED 15.6538	SURG 16.0294
PEDS 16.0500	ICU 16.1538			

Community Size:

RURAL 1.0000	PSYCH 2.4000	AUX 2.5000	OBS 2.5000	MED 2.6154
PEDS 2.6500	SURG 2.7647	ICU 2.7692	REHAB 2.8571	

[a]Subunits in the same boxes indicate the differences were not significant at 0.05 level.

Autonomy. Subunit autonomy was measured by 15 questionnaire items. Ten questions (items 60 to 69) asked the headnurses to indicate how frequently they participated in administrative decisions for their subunit. The types of decisions included in the questions were similar to those used by Inkson, Pugh and Hickson (1970) and related to budgeting, hiring and firing staff, planning and evaluation of services, and so on. A five point response scale (never, seldom, sometimes, often, always) was provided. The remaining five questions (items 70 to 74) focussed upon the subunit's autonomy in clinical decisions and in particular the degree to which the subunit could make decisions about patient care independently from physicians. These questions were similar to those used to measure decentralization in decision-making from physicians; however, for the measure of autonomy the questions were asked of the headnurse who responded for the subunit as a whole. For items 71 to 74 the headnurses were asked to indicate the extent to which they strongly agreed, agreed, disagreed, or strongly disagreed with the statements provided. Items 60 to 70 were scored 1 to 5, a response of always participating in decisions receiving a score of 5 and indicating high autonomy. Items 71 to 74 were scored 1 to 4; for items 71 to 73, a response of strongly disagree received a score of 4 and for item 74 a response of strongly agree received a score of 4. A high score indicated high autonomy.

Two composite autonomy scores were calculated for each subunit: 1) the degree of autonomy from physicians; and 2) the degree of autonomy from nursing administration. For the composite measure of autonomy from physicians, the responses to items 70, 71, 72, 73 and 74 were added for each subunit. The range of possible scores for autonomy

from physicians was from 5 to 21. The actual subunits' scores (n = 150) ranged from 6 to 20. The mean score was 15.8289, with a standard deviation of 2.6263. The Alpha reliability coefficient for these items was 0.73190. For the composite measure of autonomy from nursing administration, each subunit's scores on items 60 to 69 were added. The total possible score for autonomy from nursing administration ranged from 10 to 50. The actual subunits' scores (n = 150) ranged from 14 to 46. The mean score was 31.2311, with a standard deviation of 7.0773. The Alpha reliability coefficient for these items was 0.82343.

Complexity. The measures of perceived environmental complexity focussed upon the number and heterogeneity of other groups in the hospitals interacting with the subunit. Two measures of environmental complexity were developed: 1) medical complexity; and 2) complexity of other departments and subunits within the hospital.

Two questions (items 12 and 13) were given to the headnurses for the measure of medical complexity. The first question asked the headnurses to indicate how many physicians were allowed to admit patients to their unit; the second question asked the headnurses to indicate how many medical specialities were included in their unit. For both questions the headnurses were provided with a response scale from 1 --- 10, and more than 10; a response of more than 10 was given a score of 11. In order to develop a composite score for medical complexity for each subunit, each unit's responses to items 12 and 13 were added. The range of possible and actual scores for medical complexity was 2 to 22. The mean score on medical complexity across all subunits (n = 152) was 12.5724, with a standard deviation of 4.9173.

In order to develop a composite score for the complexity of other groups and departments interacting with the nursing subunit (other complexity) each subunit's responses to items 18, 22 and 23 were added. Question 18 provided a list of 17 possible paramedical services. The headnurses were asked to indicate which of the services were frequently used on their subunit. Question 22 asked the headnurses to indicate whether their unit had regular contact with the operating room, emergency department, ambulatory care and admitting department. Question 23 requested the headnurses to indicate which types of nursing subunits their unit had frequent contact with. For the composite measure of other complexity the range of possible scores was from 0 to 29, that is, each subunit on this measurement scale, could have regular contact with up to at least 29 different groups in the hospital excluding physicians. The range of actual scores on the measure of other complexity was 2 to 22; the mean score across all subunits (n = 153) was 10.1895 with a standard deviation of 4.0632. The Alpha reliability coefficient for combining items 18, 22, and 23 was 0.19437 suggesting a lack of homogeneity for the three items; however, this finding was not unexpected given the variety of other groups, subunits and departments listed in the three items.

Pervasiveness. In order to examine the extent to which nursing subunits were perceived to be permeated by other groups, subunits and departments within the hospital, two measures of pervasiveness were developed: 1) pervasiveness by physicians; and 2) pervasiveness by other groups and departments.

Medical pervasiveness was measured by nine questions given to the headnurses. These questions were intended to obtain each headnurse's

impressions of how much impact physicians had upon the subunit's operations. The items related to the frequency of telephone calls to physicians (item 24), the frequency of emergency calls and cardiac arrest calls (items 25 and 26) and the frequency of referrals to consulting physicians (item 27). In addition, there were five questions about attending physicians' visits to the subunits regarding, the frequency of the visits (item 30), the times of day and night the physicians were present (item 28), how long they were present at each visit (item 29), the reasons for the visits (item 34) and who accompanied physicians on patients' rounds (item 31). In order to calculate a composite measure for medical pervasiveness, each subunit's responses to items 24 to 31 and 34 were added. The possible responses available for these items are shown in Appendix 1. A four, five or six point scale was used, tailored to the individual question. The Alpha reliability coefficient for testing the homogeneity of these items was 0.61858. The possible range of scores for the composite measure of medical pervasiveness was 9 to 44. The actual range of scores was 14 to 37. The mean medical pervasiveness across all subunits (n = 141) was 22.9655 with a standard deviation of 4.6194.

The measure of pervasiveness into the nursing subunit of groups and departments in the hospital other than physicians (other pervasiveness) was developed from a series of 12 questions to the headnurses. Three questions were concerned with the pervasiveness into the nursing subunit of paramedical groups (items 36, 37 and 38), two questions related to service departments (items 39 and 40) and four questions asked about the involvement of the nursing supervisor in nursing subunit operations (items 41 to 44). Three questions were related to the sub-

unit's interaction with the emergency department (item 45), operating room (item 46) and admitting department (item 48). The possible responses for the items on pervasiveness by other groups were mostly worded in terms of the frequency of the subunit's interaction with the various departments. A scale from almost never, about once a month, about once a week, about once a day to several times a day was provided and scored 1 to 5. A composite score for other pervasiveness was developed for each subunit by adding together each subunit's responses to items 36 to 46 and 48. The Alpha reliability coefficient for the homogeneity of these items was 0.71835. The possible range of scores for the composite measure of other pervasiveness was 12 to 58. The actual range of scores was 23 to 53. The mean other pervasiveness across all subunits (n = 145) was 39.7448 with a standard deviation of 6.8321.

Pearson correlation coefficients were used to examine the relationships between the six measures of the immediate environment of nursing subunits. There were, however, few Pearson correlation coefficients which were significant at the 0.01 level (Table 17). The highest correlation was between medical pervasiveness and other pervasiveness with a Pearson r of 0.4091. This finding indicated that in subunits where there was considerable involvement of physicians, a relatively high involvement of other services in the hospital was also required. The measure of pervasiveness of other groups and departments was also significantly related to both medical and other complexity but the correlations were not high. The two measures of autonomy were correlated (r = 0.2506), however, neither of the measures of autonomy were significantly related to any of the measures of complexity or per-

Table 17

Relationships Among Measures of Immediate Environment

Pearson Correlation Coefficients

	Autonomy		Complexity		Pervasiveness	
	Med.	Admin.	Med.	Other	Med.	Other
Autonomy:						
Med.	1.0000					
Admin.	0.2506* (150)[a]	1.0000				
Complexity:						
Med.	-0.0635 (151)	0.1776 (149)	1.0000			
Other	0.1039 (152)	0.1743 (150)	0.1704 (152)	1.0000		
Pervasiveness:						
Med.	0.0745 (144)	0.1889 (142)	0.0076 (144)	0.1096 (145)	1.0000	
Other	-0.0497 (144)	-0.0465 (142)	0.2180* (144)	0.2146* (145)	0.4091* (139)	1.0000

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

vasiveness. On the whole, the six measures of the immediate environment were relatively independent. This finding suggested that the environment of the nursing subunit was perceived to be comprised of many individual and varied components which could interact independently with the subunits.

Analysis of variance was performed to examine the extent of differences between the nine types of nursing subunits on their mean scores for the six measures of the immediate environment. No significant differences ($\alpha = 0.05$) were found between the types of subunits in terms of their mean scores of autonomy from physicians (F. value = 0.707, D.F. = 151, F. prob. = 0.6853) or autonomy from administration (F. value = 0.704, D.F. = 149, F. prob. = 0.6877). In addition, no significant ($\alpha = 0.05$) differences were found between the types of subunits regarding their mean complexity of other groups, subunits and departments (F. value = 2.739, D.F. = 152, F. prob. = 0.0739). These findings indicated that neither the degree of autonomy of the subunits nor the heterogeneity of other departments interacting with the subunits were differentiated at the subunit level but probably at another broader level; perhaps for example, at the level of the total hospital or the nursing profession as a whole.

Significant ($\alpha = 0.05$) differences were found between the nine types of subunits in terms of their mean medical complexity, medical pervasiveness and pervasiveness of other groups and departments in the hospital (Table 18). For medical complexity, the Multiple range test (Table 19) showed that pediatric subunits were higher in medical complexity than all other subunits; and psychiatric and rural units were lower than all other types of subunits.

Table 18

Analysis of Variance of Differences in Mean Medical Complexity, Mean Medical Pervasiveness and Mean Other Pervasiveness by Type of Subunit

	D.F.	Sum of Sq.	Mean Sq.	F.Ratio	F.Prob.
Medical Complexity:					
Between groups	8	1291.6392	161.4549	9.785	0.0000*
Within groups	143	2359.5566	16.5004		
Total	151	3651.1958			
Medical Pervasiveness:					
Between groups	8	1116.2062	139.5258	9.698	0.0000*
Within groups	136	1956.6057	14.3868		
Total	144	3072.8117			
Other Pervasiveness:					
Between groups	8	3092.4258	386.5530	14.486	0.0000*
Within groups	136	3629.0987	26.6845		
Total	144	6721.5195			

*Indicates significant at 0.05 level.

Table 19

Multiple Range Tests for Differences in Mean Medical Complexity, Mean Medical Pervasiveness and Mean Other Pervasiveness by Type of Subunit

Medical Complexity:[a]

PSYCH 6.7333	RURAL 9.5000					
RURAL 9.5000	SURG 11.5152	AUX 11.9000	ICU 12.5385	OBS 13.1528	MED 13.7600	REHAB 13.8571
PEDS 18.1053						

Medical Pervasiveness:

AUX 17.2000	REHAB 18.5000				
PSYCH 21.7143	PEDS 22.6842	OBS 22.8461	SURG 23.3636	RURAL 24.4000	MED 24.5909
ICU 29.0000					

Other Pervasiveness:

PSYCH 29.2143				
AUX 34.6667	REHAB 35.1667	OBS 36.6154		
ICU 41.3846	PEDS 42.1667	MED 42.6956	SURG 43.000	RURAL 44.7778

[a]Subunits in the same boxes indicate the differences were not significant at 0.05 level.

For medical pervasiveness, intensive care units were higher than all other types of subunits and auxiliary and rehabilitation units were significantly lower than the other types of subunits. For pervasiveness of other groups and departments, psychiatric units were significantly lower than the other types of subunits. Auxiliary, rehabilitation and obstetrical units were greater in their mean other pervasiveness than psychiatric units but lower than the other types of subunits. Intensive care, pediatric, medical, surgical and rural units appeared to be equivalent in their degree of pervasiveness by other groups and departments in the hospitals.

The results of the analysis of variance on the measures of the immediate environment by type of subunit confirmed that the types of subunits, to some degree, perceived their immediate environments in similar ways. The similarity was most evident in relation to their perceived autonomy and the range of other departments with which they had contact. However, the subunits were different in their interaction with physicians, in terms of both complexity and pervasiveness, and in the perceived impact of other departments upon subunit operations. The ordering of the types of subunits on medical complexity, medical pervasiveness, and pervasiveness of other departments, was not the same; this finding suggested that for these aspects of the immediate environment the types of subunits had a rather individualized pattern of interaction with the groups with which they had contact. The results were, however, in keeping with the author's practical experience and were, as a consequence, judged to provide some evidence of face validity of the measures.

As a final step in the development of the measures of subunit environment, the relationships between the four measures of the secondary environment and the six measures of the immediate environment were examined. As may be seen in Table 20, however, there were few Pearson correlation coefficients which were significant at 0.01 level and where relationships were found these were not high. Hospital size, teaching status, and location were all related to complexity of other groups in the hospital; teaching status and structural differentiation were related to the pervasiveness of other groups and departments. These findings were anticipated in that larger more complex hospitals tend to provide a greater proliferation of ancillary services. Physicians as a component of the immediate environment were not, on the whole, significantly related to the hospital characteristics, with the exception of a relationship between hospital structural differentiation and medical pervasiveness and a relationship between hospital location and perceived autonomy from physicians. Overall, the measures of secondary and immediate environments appeared relatively independent which provided some validity for the methodology of dividing the environment into the two distinct levels.

Conclusions

The preceding analysis was performed in order to prepare the data on structure, technology, size, and environment for multivariate analysis. There were three basic procedures involved: 1) aggregating within subunit responses to form subunit scores for each variable; 2) summarizing multiple indicators of the same concept to form composite measures; and 3) evaluating the reliability and validity of the measures.

Table 20

Relationships Between Measures of Secondary Environment and Measures of Immediate Environment Pearson Correlation Coefficients

Secondary Environment	Immediate Environment					
	Autonomy		Complexity		Pervasiveness	
	Med	Admin.	Med	Other	Med	Other
Hospital Size	0.1756 (152)[a]	0.0013 (150)	-0.1871 (152)	0.2180* (153)	0.1741 (145)	0.1865 (145)
Teaching Status	0.1384 (152)	0.0786 (150)	-0.0152 (152)	0.2294* (153)	0.1424 (145)	0.2361* (145)
Structural Differentiation	0.1236 (152)	0.0975 (150)	0.0901 (152)	0.1799 (153)	0.2248* (145)	0.2646* (145)
Community Size	0.2757* (152)	0.1873 (150)	0.0835 (152)	0.2788* (153)	0.0480 (145)	0.0708 (145)

*Significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

In summary, the results of these procedures were as follows.

Subunit structure was divided into dimensions of complexity, formalization, and decentralization. Complexity was measured by creating three indicators: the R.N. ratio; the bureaucratization of professional nurses; and the clerical ratio. The information for these variables was obtained from the nursing administrators. The R.N. ratio and clerical ratio were found to be negatively related to the measure of bureaucratization of professional nurses. The three indicators were considered to be of acceptable validity because of the manner in which they discriminated between the nine types of subunits. Formalization was divided into dimensions of role definition and role specificity. Role definition was measured by questioning the nursing administrator about whether 22 written documents were available for each subunit. Role specificity was measured by six questions to nursing staff within each subunit. Subunit scores were developed by aggregating the responses from within each unit to form a subunit score and then adding the scores for the six items to form a composite measure of role specificity. The Alpha reliability coefficient suggested that the six items were homogeneous. Role definition and role specificity were not found to be significantly related. No significant differences were found between the types of subunits in terms of either measure of formalization, however, both measures were retained in the research because of their importance in previous research.

Decentralization was measured by seven questions asked of nursing staff in each subunit. Unit scores were obtained by calculating the mean of within subunit responses. Two measures of decentralization were derived: decentralization from physicians, by adding subunit

scores on three items; and decentralization from the headnurse, by combining scores on four items. Both measures of decentralization were shown to be internally homogeneous by high Alpha coefficients. The two types of decentralization were negatively related. Significant differences were found between the nine types of subunits in terms of the two measures of decentralization although the differences were not clearcut.

The measure of technology was derived from 18 questions asked of the nurses within each subunit which were then aggregated to form unit scores on each item. Three measures of technology were produced in the form of factor scores obtained from an oblique factor solution based on the subunit scores. These measures were labelled instability, uncertainty and variability. Instability and uncertainty were positively related. The reliability and validity of the measures were judged to be satisfactory because of the similarities between the results of this study and a previous study using the same technological items (Overton, Schneck and Hazlett, 1977).

Subunit size was measured in terms of the numbers of beds within each subunit. This information was obtained from the nursing administrators. The measure was considered reasonably valid because of the manner in which it discriminated between the nine types of subunits.

Subunit environment was measured at the secondary and immediate levels. Secondary environment data which included hospital size, teaching status, location and structural differentiation were obtained from the Canadian Hospital Directory (1977) for the 24 hospitals. Subunit scores were generated from the hospital measures. The four measures of the secondary environment were interrelated.

The immediate environment was measured by asking questions of the headnurse for each subunit. The immediate environment was measured by the degree of complexity and pervasiveness of physicians and other groups in the hospital with which each subunit interacted and the degree of subunit autonomy from these groups. Composite scores for each of the six measures of the environment were calculated by adding scores for the items measuring each variable. Although some relationships were found between the six measures no pattern of relationships amongst the variables was discernable.

Given the exploratory nature of the measurement of subunit environment in this study, to some degree, the reliability and validity of the measures were unknown. High Alpha reliability coefficients for the scales of autonomy and pervasiveness suggested considerable internal homogeneity of these measures. The relatively low Alpha coefficient for the measure of other complexity indicated that more than one component of the environment was being measured; however, this finding was expected given the nature of the questions.

Significant differences between the nine types of subunits were found in terms of most of the secondary and immediate environment variables with the exceptions of autonomy, other complexity and community size. All the ten measures of environment were retained for use in further analysis because of the exploratory nature of the conceptualization and measurement of this concept. There were few significant relationships between the four measures of the secondary environment and the six measures of the immediate environment; the lack of relationships, however, provided some evidence of the validity of separating the conceptualization of the subunit environment into two distinct levels.

CHAPTER V

SEPARATE RELATIONSHIPS OF TECHNOLOGY, SIZE AND ENVIRONMENT TO STRUCTURE

The results presented in this chapter are concerned with testing hypotheses 1.1 to 4.4 (Chapter III). The objectives of this analysis were to explore the separate associations of technology, size, and environment to structure. This type of approach has been most frequently employed in previous research. Pearson correlation coefficients were used to measure the strength of linear relationships between variables. In addition, eta-squared statistic (correlation ratio) was used as a measure of the total (linear and nonlinear) variance explained by each contingency variable for each structural variable. The level of significance employed for both Pearson correlation coefficients and eta-squared was 0.01.

Complexity, Formalization, and Decentralization

On the basis of previous research it was expected that the measures of structural complexity, formalization, and decentralization would be interrelated. Three hypotheses were suggested. First, it was proposed that structural complexity would be negatively associated with formalization. The Pearson correlation coefficients for the measures of structural complexity and formalization are shown in Table 21.

When structural complexity was measured by the R.N. ratio and when formalization was measured by role specificity the hypothesis was, to some extent, confirmed by a Pearson r of -0.2916 between the two measures. When structural complexity was measured by the cleri-

Table 21

Relationships Between Structural Complexity, Formalization and Decentralization Pearson Correlation Coefficients

	Formalization		Decentralization	
Structural Complexity	Role Definition	Role Specificity	from Physicians	from Headnurse
R.N. Ratio	0.1279 (148)[a]	-0.2916* (147)	-0.2690* (147)	0.2924* (147)
Bureaucratization of Prof. Nurses	-0.1316 (148)	0.0840 (147)	0.0195 (147)	-0.1957* (147)
Clerical Ratio	0.3566* (148)	-0.0375 (147)	-0.1241 (147)	0.1715 (147)

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

cal ratio and formalization by role definition a Pearson r of 0.3566 was observed suggesting a positive relationship between structural complexity and formalization. No significant relationships were found between the measure of the degree of bureaucratization of professional nurses and either measure of formalization.

The relationship between the R.N. ratio and role specificity was in keeping with previous research in human service organizations which has suggested that there is a tendency for fewer rules and regulations when more professionally qualified persons are employed (Hage and Aiken, 1967). This finding, however, was contradictory to the results of Comstock and Scott (1977) who found that the R.N. ratio was positively related with the degree of standardization of nursing procedures.

The relationship between the clerical ratio and the role definition was consistent with research which has measured formalization by the extent of written documentation (Child, 1973; Hall, Haas and Johnson, 1967).

The second hypothesis suggested that structural complexity would be positively related to decentralization in decision-making. As illustrated in Table 21, the R.N. ratio was related to decentralization from the headnurse (Pearson r of 0.2924) and decentralization from physicians (Pearson r of -0.2690). The degree of bureaucratization of professional nurses was weakly related to decentralization from the headnurse with a Pearson r of -0.1957. No significant relationships were apparent between the clerical ratio and the measures of decentralization.

To some degree, the findings of associations between the R.N. ratio and decentralization confirmed the hypothesis and were consistent with the general view of professional organizations (Friedson, 1973; Hall, 1968). The results were, however, in contrast to the findings of Comstock and Scott (1977) who found an association between the R.N. ratio and centralization of decision-making. The negative relationships between bureaucratization and decentralization indicated that where the majority of the professional nurses were employed in leadership positions there was a greater tendency for decisions to be centralized; this finding could be expected.

The third hypothesis in this series proposed a negative relationship between formalization and decentralization. As illustrated in Table 22, a correlation of -0.2780 was found between role specificity and decentralization from the headnurse which provided some support for the hypothesis. In addition, a correlation of 0.2685 was observed between role specificity and decentralization from physicians. This finding was not unanticipated given the negative relationship between the two measures of decentralization. No relationships were found between role definition and decentralization.

Overall, the relationships found between role specificity and decentralization were consistent with the research of Hage and Aiken (1967); however, Comstock and Scott (1977) had observed no relationship between standardization and centralization of decision-making. The lack of relationship between role definition and decentralization was not consistent with the work of Child (1973) which had implied that decentralization tended to be accompanied by an increase in written documents in order to maintain control over procedures and

Table 22

Relationships Between Formalization and Decentralization

Pearson Correlation Coefficients

Formalization	Decentralization From Physicians	Decentralization From the Headnurse
Role Definition	0.0455 (155)[a]	0.0181 (155)
Role Specificity	0.2685* (156)	-0.2780* (156)

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subnits responding to all items in the measures.

and performance.

In order to find out if there were nonlinear relationships amongst the structural measures eta-squared was calculated. For this analysis, the measures of structural complexity were treated as independent variables and formalization and decentralization as dependent variables. The R.N. ratio, bureaucratization of professional nurses, and the clerical ratio variables were recoded into categorical levels of measurement so that subcategory means could be obtained. The nonlinear relationships between the means of each subcategory and the dependent variables (formalization and decentralization) were then examined individually by the eta-squared statistic. In all of these bivariate analyses the F. values were not significant at the 0.01 level. These findings indicated that there were no nonlinear relationships between the measures of structural complexity and both formalization and decentralization.

In summary, some support was provided for the hypothesized relationships amongst structural complexity, formalization and decentralization. Two main patterns of relationships were observed. First, when structural complexity was measured by the R.N. ratio it was found to be associated with decentralization from the headnurse, centralization to physicians, and lack of role specificity. Second, when structural complexity was measured by the clerical ratio, it was found to be linearly associated with role definition as indicated by the number of documents available to nurses. These patterns were consistent with previous research with the exception of the study of nursing subunits by Comstock and Scott (1977). No nonlinear relationships were apparent between structural complexity and measures of

formalization and decentralization.

Technology and Structure

Three hypotheses (2.1 to 2.3) were proposed for the relationships between technology and structure.

It was hypothesized that high technological uncertainty would be associated with high structural complexity, low formalization, and high decentralization. As indicated in Table 23, uncertainty in technology was correlated 0.2788 with the R.N. ratio but not significantly related to the other two measures of structural complexity. Uncertainty was also negatively associated with formalization when this was measured by role specificity. Technological uncertainty was found to be associated with decentralization from the headnurse (Pearson r of 0.3008) and negatively correlated (Pearson r of -0.2446) with decentralization from physicians.

These findings were consistent with the hypothesis and suggested that subunits characterized by uncertainty in the technology tended to employ more R.N.s, decentralize decisions from the headnurse, centralize decisions towards physicians, and have few rules and regulations guiding nursing behavior.

The second hypothesis suggested that high technological instability would be associated with high structural complexity, low formalization and high decentralization. As shown in Table 23, a strong linear relationship was found between instability in the technology and the R.N. ratio (Pearson r of 0.5232) but the associations between instability and the other two measures of structural complexity were not significant at 0.01 level. Formalization was not related to

Table 23

Relationships Between Technology and Structure

Pearson Correlation Coefficients

	Structure						
	Complexity			Formalization		Decentralization	
Technology	R.N. Ratio	Bureaucratization of Prof. Nurses	Clerical Ratio	Role Definition	Role Specificity	From Physicians	From Headnurse
Uncertainty	0.2788*	-0.0135	0.0492	-0.0805	-0.2314*	-0.2446*	0.3308*
	(147)	(147)	(147)	(155)	(156)	(156)	(156)
Instability	0.5232*	-0.1632	0.1289	0.0503	-0.0334	-0.2574*	0.1793
	(147)	(147)	(147)	(155)	(156)	(156)	(156)
Variability	-0.0316	-0.0673	0.1817*	0.0763	-0.1210	0.0673	0.1425
	(147)	(147)	(147)	(155)	(156)	(156)	(156)

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

instability in the technology. A correlation of -0.2574 was found between instability and decentralization from physicians but the relationship between instability and decentralization from the headnurse was not significant. These results implied that when subunits were characterized by instability in their technology there was a tendency for a larger proportion of the nursing staff to be professionally qualified and for decisions to be more centralized to physicians. In this regard, only part of the hypothesis was confirmed.

The third hypothesis in this series proposed that high variability in the technology would be related to high structural complexity, low formalization, and high decentralization. This hypothesis was not supported apart from a weak (Pearson r of 0.1817) relationship between variability and the clerical ratio.

The extent of nonlinear relationships between technology and structure was also examined by the eta-squared statistic. For this procedure, the factor scores for technological uncertainty, instability and variability were recoded into categorical levels of measurement and the means of the subcategories used to examine the relationships between the recoded technology variables and the structural measures. The eta-squared for each of the bivariate analyses was not significant at 0.01 level indicating there were no nonlinear relationships between technology and structure.

In general, however, the observed relationships between technology and structure provided some support for the hypotheses and were consistent with previous research in human service organizations. Hage and Aiken (1968) had found similar relationships between the degree of routineness of technology and the proportion of profession-

al workers employed, formalization and decentralization. In addition, Comstock and Scott (1977) observed a similar pattern of associations between predictability of nursing tasks and the R.N. ratio, standardization and decentralization in decision-making.

The findings of the current study, however, illustrated the importance of a multidimensional approach to the measurement of technology since different relationships with structure were observed for uncertainty and instability in the technology. In addition, variability in the technology which has been considered by several researchers as an important technological construct was not found to be strongly related to any of the structural measures. The lack of nonlinear relationships between the measures of technology and structure indicated that associations between technology and structure were primarily linear.

Size and Structure

Three hypotheses were proposed for guiding the analysis of relationships between size and structure (3.1 to 3.3). First, it was suggested that larger subunits would be characterized by lower structural complexity. This hypothesis was strongly supported by the finding of a Pearson correlation coefficient of -0.4726 between the R.N. ratio and subunit size and a coefficient of 0.5307 with the degree of bureaucratization of professional nurses (Table 24). No linear relationship was found between subunit size and the clerical ratio.

In order to examine possible nonlinear relationships between subunit size and structural complexity, subunit size was recoded into

Table 24

Relationships Between Size and Structure

Pearson Correlation Coefficients

	Structure						
		Complexity		Formalization		Decentralization	
Size	R.N.Ratio	Bureaucratization of Prof. Nurses	Clerical Ratio	Role Definition	Role Specificity	From Physicians	From Headnurse
Number of Beds	-0.4726* (148)[a]	0.5307* (148)	0.0011 (148)	0.1663 (156)	0.1902* (155)	0.0967 (155)	-0.1659 (155)

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

six categories with intervals 1-20, 21-25, 26-30, 31-35, 36-40, and 40-75 beds. The eta-squared statistic was calculated for the relationships between subunit size and the R.N. ratio, bureaucratization of professional nurses, and the clerical ratio. Eta-squared was not significant at the 0.01 level between subunit size and the R.N. ratio indicating that the relationship between these two variables was primarily linear as shown by the Pearson correlation coefficient of -0.4726.

For subunit size and the other two measures of structural complexity (bureaucratization of professional nurses and clerical ratio) significant nonlinear relationships were observed. The results are shown in Table 25.

From the mean bureaucratization of professional nurses by category of subunit size (Table 25) it may be noted that mean bureaucratization of professional nurses increased with increases in size until subunit size reached a mean of 28.515 beds. For subunits of mean number of beds of 33.067 and 37.696, bureaucratization of professional nurses decreased but for subunits with mean number of beds of 52.239, bureaucratization increased again. This large increase in bureaucratization of professional nurses with the highest category of subunit size was most likely due to the auxiliary units in the study which were, in general, larger than other units and had greater bureaucratization of professional nurses; however, no adequate explanation could be provided for the decrease in bureaucratization for the medium sized subunits.

A number of attempts were made to restate the relationship between subunit size and bureaucratization of professional nurses by

Table 25

Nonlinear Relationships Between Size and Structural Complexity

	Size[a] Subunit Beds		Structural Complexity: Bureaucratization of Prof. Nurses		Structural Complexity: Clerical Ratio		
	Category Mean	SD	Mean	SD	Mean	SD	N
	14.070	5.732	0.117	0.061	0.037	0.037	26
	23.450	1.669	0.158	0.097	0.059	0.041	17
	28.515	1.372	0.167	0.106	0.049	0.022	32
	33.067	1.617	0.144	0.077	0.057	0.030	30
	37.696	1.521	0.122	0.062	0.075	0.029	23
	52.239	10.954	0.351	0.393	0.035	0.031	20
Total	30.603	12.398	0.171	0.171	0.052	0.030	148

	Bureaucratization of Prof. Nurses	Clerical Ratio
r^2	0.0646	0.0106
F. value	11.104 *	1.766
eta-squared	0.1744	0.1506
F. value	4.725 *	5.853 *

*Indicates significant at 0.01 level.

[a]Recoded into categories of intervals 1-20, 21-25, 26-30, 31-35, 36-40, 40-75 beds.

transforming the variable subunit size through natural log functions and the use of polynomial regression; however, the relationship as expressed by the Pearson correlation coefficient of 0.5307 could not be improved upon.

The Pearson correlation coefficient between size and the clerical ratio had indicated no significant linear relationship; the eta-squared of 0.1506 (Table 25), however, showed significant non-linearity. Small subunits (mean 14.070 beds) and large subunits (mean 52.239) were both characterized by relatively small clerical ratios. The small subunits were most likely to be intensive care units which, in general, have a large number of personnel with only a few clerical staff; the large subunits were most likely the auxiliary units with generally a small number of personnel and very few clerical staff. The largest clerical ratio was observed for subunits with about 38 beds; these units were probably medical and surgical units which typically have a reasonable amount of routine clerical work and, hence, a relatively large clerical ratio.

An attempt was made to restate the relationship between subunit size and the clerical ratio by using natural log functions and polynomial regression. Significant increases in the proportion of variance in the clerical ratio which could be accounted for by subunit size was obtained by using both number of subunit beds and number of subunit beds-squared combined. The results of stepwise regression attempting to explain variance in the clerical ratio using these two variables is shown in Table 26. The combination of beds and beds-squared produced an R square value of 0.17471 with a standard error of 0.03071 (D.F. regression 2, residual 145; F. value of 15.34841;

Table 26

Stepwise Regression to Explain Variance in Clerical Ratio

Using Subunit Size and Subunit Size-Squared[a]

Variable	Multiple R	R Square	Regression Coefficient	SE	Standardized Regression Coefficient
Subunit Beds	0.00108	0.00000	-0.00582	0.0011	-2.12015
Subunit Beds-Squared	0.41799	0.17471	0.06340	0.0112	2.16201
Constant			-0.11875		

[a]n = 148.

F. prob. 0.00000). These results indicated that, overall, the relationship between subunit size and the clerical ratio was nonlinear. Stepwise regression demonstrated the relationship between the clerical ratio and subunit size was best represented by a second degree polynomial which utilized beds and beds-squared.

It was also hypothesized that larger subunits would be characterized by greater formalization. This hypothesis was only weakly supported by a Pearson correlation coefficient of 0.1902 between subunit size and role specificity; no relationship was found between size and role definition (Table 24). In addition, there were no significant ($\alpha = 0.01$) nonlinear relationships observed between subunit size and either measure of formalization.

The third hypothesis proposed that larger subunits would be characterized by less decentralization and no support was provided for this hypothesis. Neither the linear nor nonlinear relationships between size and measures of bureaucratization were significant at 0.01 level.

The findings from previous research concerning the relationships between size and structure have generally been inconsistent. Both positive (Terrien and Mills, 1955) and negative (Anderson and Warkov, 1961) associations have been found between size and administrative intensity in previous studies. Although this current research did not attempt to measure administrative intensity specifically, the strong linear relationship between size and the degree of bureaucratization of professional nurses suggested a positive association between size and administrative intensity. This finding indicated that subunits with a larger number of beds, for example, auxiliary units, tended to

employ a larger proportion of the professional nurses in formal leadership positions in order to coordinate and monitor the activities imposed by the larger unit.

The negative relationship between size and the R.N. ratio was consistent with the research of Comstock and Scott (1977) and Heydebrand's study (1973) of hospitals as a whole. In business organizations and at the level of the total organization a positive relationship between organizational size and structural complexity has been found (Child, 1973).

Probably the most interesting finding from this analysis was the nonlinear relationship between subunit size and the clerical ratio. Both small and large subunits were found to have relatively low clerical ratios while subunits with about 38 beds tended to have the highest clerical ratios. By using a second degree polynomial it was possible to explain over 17 percent of the variance in the clerical ratio.

Overall, it was quite clear that subunit size was an important variable in relation to structural complexity but relatively unimportant for formalization and decentralization. Apart from a weak linear relationship between size and formalization there were no other significant linear or nonlinear relationships between size and the measures of formalization and decentralization.

Environment and Structure

The pattern of relationships between environment and structure at the subunit level of analysis has not been extensively investigated. Four exploratory hypotheses (4.1 to 4.4) were proposed for the

relationships between the environment and subunit structure.

Secondary Environment and Structure

It was hypothesized that high complexity in the secondary environment (as indicated by hospital size, teaching status, community size, and structural differentiation) would be associated with high structural complexity, low formalization, and high decentralization in nursing subunits. As illustrated in Table 27, the measures of the secondary environment were linearly related to structural complexity in nursing subunits. Hospital structural differentiation, as measured by the number of directors of departments, was correlated 0.3060 with the R.N. ratio. Structural differentiation and teaching status were both correlated (-0.2745 and -0.2194 respectively) with the degree of bureaucratization of professional nurses. Hospital size, teaching status, community size, and structural differentiation were all observed to be related to the clerical ratio (0.2980, 0.3099, 0.2506 and 0.3505 respectively).

In addition to examining the linear relationships between the measures of the secondary environment and structural complexity, nonlinear associations were explored. No significant nonlinear relationships were observed between the community size and structural complexity; however, some significant nonlinear relationships were observed for both hospital size and hospital structural differentiation with structural complexity. The results are shown in Table 28.

For this analysis, hospital size was recoded into seven categories (1-100, 101-200, 201-300, 301-400, 401-500, 501-600, 601-700, 701-800, 801-1200 beds). As may be observed from Table 28, the eta-squared between hospital size and the R.N. ratio was 0.3118. The

Table 27

Relationships Between Secondary Environment and Structure

Pearson Correlation Coefficients

	Structure						
		Complexity		Formalization		Decentralization	
Secondary Environment	R.N.Ratio	Bureaucratization of Prof. Nurses	Clerical Ratio	Role Definition	Role Specificity	From Physicians	From Headnurse
Hospital Size	0.1826 (148)[a]	-0.1234 (148)	0.2980* (148)	-0.2763* (156)	0.0276 (156)	-0.1524 (156)	0.0783 (156)
Teaching Status	0.1048 (148)	-0.2194* (148)	0.3099* (148)	-0.1669 (156)	0.0916 (156)	-0.1298 (156)	0.0351 (156)
Structural Differen-tiation	0.3060* (148)	-0.2745* (148)	0.3505* (148)	0.0085 (156)	0.0451 (156)	-0.1659 (156)	0.0821 (156)
Community Size	0.0739 (148)	0.0690 (148)	0.2506* (148)	-0.08990 (156)	0.0450 (156)	-0.16347 (156)	-0.06406 (156)

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

Table 28

Nonlinear Relationships Between Secondary Environment and Structural Complexity

Secondary Environment			Structural Complexity: R.N. Ratio		Bureaucratization of Professional		Clerical Ratio		
	Category Mean	SD	Mean	SD	Mean	SD	Mean	SD	N
Hospital Size:[a]									
	73.050	24.580	0.558	0.159	0.136	0.105	0.026	0.028	18
	132.667	3.615	0.482	0.103	0.115	0.051	0.030	0.019	6
	238.714	31.629	0.647	0.194	0.118	0.065	0.055	0.038	33
	360.737	6.8867	0.362	0.147	0.398	0.374	0.037	0.027	19
	520.000	0.0	0.389	0.043	0.367	0.074	0.047	0.006	7
	708.000	0.0	0.724	0.144	0.108	0.031	0.095	0.025	10
	1051.000	72.734	0.622	0.163	0.127	0.053	0.058	0.029	55
Total	581.185	48.890	0.577	0.162	0.171	0.147	0.052	0.030	148
r^2			0.0317		0.1038		0.0087		
F. value			6.497		19.350 *		1.845		
eta-squared			0.3118		0.2437		0.3338		
F. value			11.478 *		5.215 *		13.758 *		
	Category Mean	SD	Mean	SD	Mean	SD	Mean	SD	N
Structural Differentiation:[b]									
	3.5	1.269	0.498	0.126	0.117	0.064	0.028	0.031	8
	7.133	0.743	0.447	0.221	0.437	0.425	0.015	0.021	15
	11.784	1.026	0.541	0.202	0.168	0.105	0.052	0.031	49
	16.686	0.648	0.631	0.173	0.119	0.065	0.062	0.030	47
	19.000	0.0	0.724	0.144	0.108	0.030	0.096	0.025	10
	21.000	0.0	0.592	0.139	0.147	0.039	0.041	0.020	19
Total	14.038	0.797	0.577	0.181	0.171	0.153	0.052	0.028	148
r^2			0.0692		0.0586		0.0697		
F. value			11.383 *		11.472 *		14.286 *		
eta-squared			0.1343		0.2749		0.3073		
F. value			2.666		10.590 *		12.175 *		

*Indicates significant at 0.01 level.

[a]Recoded into categories of intervals 1-100, 101-200, 201-300, 301-400, 401-500, 501-600, 601-700, 701-800, 801-1200 beds.

[b]Recoded into categories of intervals 1-5, 6-9, 10-13, 14-17, 18-20, 21-22 directors.

lowest mean R.N. ratios were observed for hospitals with a mean number of beds of 360.737 and 520.000. The hospitals falling into the 361 bed range were some of the rural hospitals and the one hospital classified as a chronic hospital (Canadian Hospital Directory, 1977). There were 5 subunits from this hospital in the study. The chronic hospital was built in 1956 and had 350 beds, employed 323 staff, was owned by a religious order, and had an average patient length of stay of 432 days; it was not a teaching hospital. Only one hospital in the study had a mean size of 520 beds and this was a psychiatric hospital. This hospital was built in 1911 and provincially owned; it employed 720 staff and was not a teaching facility. These findings, on the whole, suggested that chronic and psychiatric hospitals may tend to employ a lower proportion of professional nurses which was in keeping with the author's practical experience.

The highest mean R.N. ratio occurred for one hospital with 708 beds. This hospital (referred to from here on as Hospital X) was a provincial teaching hospital located in an urban centre in Alberta. Although built in 1966, hospital X was newer than all the other hospitals in the study with the exception of one rural hospital with 100 beds. The hospital was a general acute hospital employing 1862 staff and with an average length of stay of patients of about 10 days.

When the nonlinear relationship between hospital size and the degree of bureaucratization of professional nurses was examined, a significant ($\alpha = 0.01$) eta-squared of 0.2437 was observed. The mean bureaucratization by category of bed size showed a similar pattern to the R.N. ratio. The chronic and psychiatric hospitals were highest in bureaucratization of professional nurses and hospital X was lowest

(Table 28).

A significant nonlinear relationship was also found between hospital size and the clerical ratio with an eta-squared of 0.3338. On closer examination of the mean clerical ratio by category of hospital size, a similar pattern of relationship was observed for the chronic and psychiatric hospitals and hospital X as was observed for the other measures of structural complexity (Table 28).

Also illustrated in Table 28 are the nonlinear relationships between hospital structural differentiation and the measures of subunit structural complexity. For this analysis, structural differentiation was recoded into six categories (1-5, 6-9, 10-13, 14-17, 18-20, 21-22 directors). The nonlinear relationship between structural differentiation and the R.N. ratio was not significant at the 0.01 level; however, the nonlinear relationships between structural differentiation and bureaucratization of professional nurses and the clerical ratio were significant.

A high mean bureaucratization of professional nurses was apparent for hospitals with a mean number of directors of 7.133. On closer examination these hospitals were found to be small rural hospitals. The lowest mean bureaucratization of professional nurses occurred in correspondence with 19 directors; hospital X was found to be the only hospital in this study with 19 directors.

A similar pattern was observed between hospital structural differentiation and the clerical ratio. Hospital X, with 19 directors, had the highest mean clerical ratio (0.096) and the small rural hospitals, with a mean of 7.133 directors, had the lowest mean clerical ratio of 0.015.

The extent of linear relationships between the measures of secondary environment and formalization were shown in Table 27. A significant negative correlation (-0.2763) was observed between hospital size and formalization of role definition. No other linear relationships were found. When the nonlinear relationships between measures of the secondary environment and formalization were examined, significant ($\alpha = 0.01$) eta-squared were observed between hospital size and role definition and structural differentiation and role definition. These results are shown in Table 29.

In terms of hospital size and role definition an eta-squared of 0.3586 was obtained; the smallest amount of documentation occurred in subunits located in both the smallest and largest hospitals with approximately 14 documents being in general use. The subunits in hospital X (708 beds) appeared to be considerably different from the other subunits with a mean number of documents of 20.7.

In relation to structural differentiation and role definition, an eta-squared of 0.2289 was observed; subunits located in hospitals with a mean number of directors of 3.5 (small, rural hospitals) had the smallest mean number of documents (14.2) in use. In keeping with previous analysis reported above, the subunits in hospital X had a greater number of documents available than subunits located in other hospitals.

As noted in Table 27, there were no significant linear relationships between the measures of the secondary environment and the two measures of decentralization; however, significant nonlinear relationships were observed between hospital size and decentralization from the headnurse and between structural differentiation and decentrali-

Table 29

Nonlinear Relationships Between Secondary Environment and Formalization

Secondary Environment			Formalization Role Definition		
	Category Mean	SD	Mean	SD	N
Hospital Size:[a]					
	73.050	24.580	14.000	2.675	20
	132.667	3.615	18.000	1.550	6
	238.714	31.629	17.543	2.660	35
	360.737	6.8867	16.421	2.143	19
	520.000	0.0	17.000	0.0	7
	708.000	0.0	20.700	0.949	10
	1051.000	72.734	14.068	3.362	59
Total	581.185	48.890	15.833	2.760	156
r^2			0.0302		
F. value			7.017 *		
eta-squared			0.3586		
F. value			15.254 *		
Structural Differentiation:[b]			Mean	SD	N
	3.5	1.269	14.200	2.898	10
	7.133	0.743	15.733	2.433	15
	11.784	1.026	16.765	2.702	51
	16.686	0.648	14.490	3.916	51
	19.000	0.0	20.700	0.949	10
	21.000	0.0	15.316	1.916	19
Total	14.038	0.797	15.833	3.016	156
r^2			0.0024		
F. value			0.472		
eta-squared			0.2289		
F. value			11.011 *		

*Indicates significant at 0.01 level.

[a]Recoded into categories of intervals 1-100, 101-200, 201-300, 301-400, 401-500, 501-600, 601-700, 701-800, 801-1200 beds.

[b]Recoded into categories of intervals 1-5, 6-9, 10-13, 14-17, 18-20, 21-22 directors.

zation from physicians. The results of this analysis are shown in Table 30.

The eta-squared statistic for the relationship between hospital size and decentralization from the headnurse was 0.1797. The lowest amount of decentralization from the headnurse was observed for the subunits located in the chronic hospital and some rural hospitals with a mean hospital size of 360.737 and mean decentralization of 13.166. This finding was not unexpected since subunits in these types of hospitals tend to employ a high proportion of auxiliary personnel and fewer professional nurses; in such circumstances, it is unlikely that the headnurse could decentralize decision-making. The highest mean decentralization from headnurses occurred in the subunits located in the psychiatric hospital (520 beds) and hospital X (708 beds).

Examination of the nonlinearity between hospital structural differentiation and decentralization from physicians produced an eta-squared of 0.1036 (Table 30). The most noteworthy finding from this analysis was that subunits in hospital X, with 19 directors, had considerably less decentralization from physicians than subunits in other hospitals. The reasons for this finding were not clear; however, it is speculated that it may have been because of the relatively new medical school attached to the hospital which may have a different philosophy of medicine than other hospitals.

Overall, the linear relationships found between the secondary environment and subunit structural complexity were consistent with research examining relationships between organizational context and structure (Pugh, Hickson, Hinings and Turner, 1969; Child, 1973). Heydebrand (1973) also found associations between structural complex-

Table 30

Nonlinear Relationships Between Secondary Environment and Decentralization

Secondary Environment			Decentralization from Headnurse		
	Category Mean	SD	Mean	SD	N
Hospital Size:[a]					
	73.050	24.580	14.511	1.010	20
	132.667	3.615	14.080	1.001	6
	238.714	31.629	14.604	1.414	35
	360.737	6.8867	13.166	1.344	19
	520.000	0.0	15.645	1.195	7
	708.000	0.0	15.713	1.249	10
	1051.000	72.734	14.489	1.450	59
Total	581.185	48.890	14.471	1.345	156
	r^2		0.0095		
	F. value		1.725		
	eta-squared		0.1797		
	F. value		6.182 *		

			Decentralization from Physicians		
Structural Differentiation:[b]			Mean	SD	N
	3.5	1.269	7.758	0.673	10
	7.133	0.743	7.639	0.998	15
	11.784	1.026	7.300	0.850	51
	16.686	0.648	7.177	0.931	50
	19.000	0.0	6.380	0.806	10
	21.000	0.0	7.520	1.004	20
Total	14.038	0.797	7.290	0.900	156
	r^2		0.0169		
	F. value		2.825		
	eta-squared		0.1036		
	F. value		3.629 *		

*Indicates significant at 0.01 level.

[a]Recoded into categories of intervals 1-100, 101-200, 201-300, 301-400, 401-500, 501-600, 601-700, 701-800, 801-1200 beds.

[b]Recoded into cagegories of intervals 1-5, 6-9, 10-13, 14-17, 18-20, 21-22 directors.

ity of the total hospital and hospital size, teaching status, community size and a range of other contextual variables. Heydebrand, however, found negative relationships between hospital size and the administrative ratio, the professional ratio, and the clerical ratio; in this current study, hospital size and structural differentiation were, in general, positively related to structural complexity within nursing subunits.

The nonlinear relationships observed between the characteristics of the secondary environment and subunit structural complexity provided further clarification of such associations than has been available from previous research. Of particular importance was the observation that the type of hospital, for example, chronic, rural, and psychiatric or one individual hospital, for example, hospital X, could influence the relationships of hospital size and structural differentiation to measures of subunit structural complexity.

In general, there were few relationships between the characteristics of the secondary environment and subunit formalization and decentralization. Nonlinear relationships were observed between both hospital size and structural differentiation and the extent to which written documents were available in subunits; also, nonlinearities were found between hospital size and decentralization from the headnurse and between hospital structural differentiation and decentralization from physicians. On the whole, these findings reflected policies of different types of hospitals, for example, the chronic, psychiatric or rural hospitals or the policy of an individual hospital, such as, hospital X.

Immediate Environment and Structure

The second hypothesis in this series proposed that subunits with high autonomy from their immediate environments would be characterized by low structural complexity, high formalization and low decentralization. When the linear relationships between autonomy and structural complexity were examined (Table 31) a weak relationship was observed between autonomy from physicians and the clerical ratio (Pearson r of 0.1968). Moderate linear relationships were, however, observed between autonomy from administration and the R.N. ratio (0.2668), bureaucratization of professional nurses (-0.2065) and the clerical ratio (0.2947). These results implied that autonomy was more likely to be associated with high structural complexity as opposed to the hypothesized low structural complexity. No linear relationships were found between autonomy and formalization and only weak relationships between the two measures of autonomy and decentralization from physicians.

Overall, the linear associations between autonomy and structural complexity were consistent with previous research with the exception of the direction of the relationship (Inkson, Pugh and Hickson, 1970; Aiken and Hage, 1968). The absence of relationships between autonomy and formalization and weak relationships between autonomy and decentralization were also in keeping with the findings of other studies (see for example: Aiken and Hage, 1968). No significant ($\alpha = 0.01$) non-linear relationships were found between subunit autonomy and the measures of structure.

The third hypothesis for relationships between the environment and structure proposed that high complexity in the immediate environ-

Table 31

Relationships Between Immediate Environment and Structure

Pearson Correlation Coefficients

Immediate Environment	Structure: Complexity R.N.Ratio	Bureaucratization of Prof. Nurses	Clerical Ratio	Formalization: Role Definition	Role Specificity	Decentralization: From Physicians	From Headnurse
Autonomy:							
Medical	-0.0913 (145)[a]	0.1012 (145)	0.1968* (145)	-0.0010 (151)	0.0275 (151)	-0.1920* (151)	0.1716 (151)
Admin.	0.2668* (143)	-0.2065* (143)	0.2947* (143)	0.1333 (149)	-0.1416 (149)	-0.1815* (149)	0.1707 (149)
Complexity:							
Medical	0.0749 (145)	-0.1912 (145)	0.0895 (145)	0.2117* (151)	0.0868 (151)	0.3438* (151)	-0.2341* (151)
Other	-0.0640 (146)	-0.0310 (146)	0.2292* (146)	-0.0157 (152)	-0.1091 (152)	0.0496 (152)	0.0322 (152)
Pervasiveness:							
Medical	0.4975* (138)	-0.3137* (138)	0.1744 (138)	0.1738 (144)	0.0001 (144)	-0.1015 (144)	0.1120 (144)
Other	0.1740 (138)	-0.2485* (138)	0.1426 (138)	-0.0103 (144)	0.0357 (144)	0.0732 (144)	-0.0391 (144)

*Indicated significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

ment would be associated with high structural complexity, low formalization and high decentralization within the nursing subunit. When the linear relationships between complexity of the environment and structural complexity were examined only one significant relationship was found (Table 31). The complexity of other groups and departments interacting with the nursing subunit was correlated 0.2292 with the clerical ratio. The complexity of physicians interacting with the subunit was correlated 0.2117 with role definition, otherwise no significant linear relationships were found between complexity in the environment and formalization. The complexity of physicians interacting with the subunit was also correlated 0.3438 with decentralization from physicians and correlated -0.2341 with decentralization from the headnurse. No significant nonlinear relationships were found between the measures of environmental complexity and structure.

Apart from the linear relationships found between environmental complexity and subunit structural complexity the hypothesis was not supported. These findings were somewhat disappointing given the strong arguments provided in the literature for the importance of environmental complexity for internal structure (Duncan, 1972; Lawrence and Lorsch, 1967).

The fourth hypothesis in this series proposed that high pervasiveness of the immediate environment into the nursing subunit would be associated with high structural complexity, low formalization and high decentralization. As illustrated in Table 31, the degree of pervasiveness of medical staff into the subunit correlated 0.4975 with the R.N. ratio and -0.3137 with the degree of bureaucratization of professional nurses. The degree of pervasiveness of other groups

and departments in the hospital into the nursing subunit was correlated -0.2485 to the degree of bureaucratization of professional nurses. No relationships were found between measures of pervasiveness and measures of formalization and decentralization.

Although there has been no previous research examining the relationships between pervasiveness of the environment and subunit structure stronger associations than those observed had been anticipated on the basis of the general literature on organization-environment relationships. The relatively strong linear relationships between the degree of pervasiveness of physicians into the subunit and the R.N. ratio and bureaucratization of professional nurses provided some encouragement for the notion that the impact of medical staff upon the subunit was important for determining structural complexity. No nonlinear relationships were found between the measures of environmental pervasiveness and the measures of structure.

This exploratory analysis of the relationships between the environment of nursing subunits and structure indicated that a rather complex pattern of associations existed. The secondary environment was more clearly related to the degree of structural complexity within nursing subunits and these results were consistent with research examining relationships between context and structure. Some nonlinear relationships were observed between two measures of the secondary environment, namely, hospital size and structural differentiation, and the measures of structural complexity; in addition, these hospital variables were also found to be nonlinearly related to some measures of decentralization and formalization. Overall, these findings indicated that the type of hospital and the unique characteristics of

individual hospitals could influence the nature of the relationships between the secondary environment and subunit structure.

When the hypotheses concerning the relationships between the immediate environment and structure were explored, the findings were less clear cut. The complexity of physicians in the immediate environment appeared to be linearly associated with the decision-making behavior within nursing subunits and the pervasiveness of physicians into the subunit appeared to be associated with structural complexity. On the whole, the complexity and pervasiveness of other groups and departments in the hospital was not found to be substantially related either linearly or nonlinearly to subunit structure. In terms of the immediate environment, the strongest pattern of relationships were observed between subunit autonomy from administration and structural complexity.

Conclusions

The findings presented in this chapter were concerned with analysing the separate relationships of technology, size and environment to subunit structure. This approach has been characteristic of most of the previous research since in many studies a comprehensive range of contingency variables has not been taken into consideration. In addition, an attempt was made to examine both linear and nonlinear relationships between each contingency variable and each measure of structure.

In general, the patterns of relationships emerging from the analysis appeared to be relatively complex. None of the hypothesized relationships could be totally rejected yet in some instances only

weak support was provided.

When the relationships amongst the dimensions of structure were examined two trends were apparent. The R.N. ratio, a measure of structural complexity, was found to be significantly associated with role specificity and decentralization. The clerical ratio, a second measure of structural complexity, was found to be related to the degree of role definition when this was measured in terms of the number of written documents. Both these trends confirmed the findings of previous research.

The nature of relationships between technology and dimensions of structure appeared to depend upon which measure of technology was employed. Uncertainty in the technology was found to be linearly associated with the R.N. ratio, role specificity and the two measures of decentralization. Instability in the technology was, however, only related to the R.N. ratio and the degree of decentralization from physicians. In contrast, variability in the technology was independent from all the measures of structure with the exception of the clerical ratio. No nonlinear relationships were observed between any of the measures of technology with the structural variables. In general, the findings of associations between technology and structure were consistent with earlier studies in human service organizations.

Regarding subunit size and structure, number of subunit beds was found to be strongly and linearly associated with structural complexity when this was measured by the R.N. ratio and the degree of bureaucratization of professional nurses. Significant nonlinear relationships were also observed between subunit size and bureaucratization

of professional nurses and the clerical ratio: when a second degree polynomial was used to attempt to explain variance in the clerical ratio, considerable improvement in the amount of variance explained by subunit size was obtained.

When the relationships between the secondary environment measures and subunit structure were examined both linear and nonlinear relationships were observed. Quite clearly, the hospital characteristics were most strongly related both linearly and nonlinearly to subunit structural complexity. Significant nonlinear relationships were, however, found between hospital size and structural differentiation and selected measures of subunit formalization and decentralization. In general, the results of this series of analyses suggested that the type of hospital, for example, chronic, psychiatric, rural versus acute general, and the unique characteristics of an individual hospital, such as hospital X in this study, could influence the nature of relationships between the secondary environment and subunit structure. For example, the subunits located in the psychiatric hospital in this study appeared to have a high degree of bureaucratication of professional nurses and a high degree of decentralization of decisions from the headnurse. The subunits located in the chronic hospital tended to have high bureaucratization of professional nurses and low decentralization from the headnurse. The subunits located in hospital X, on the other hand, seemed to differ from subunits located in other hospitals in terms of high R.N. ratio, low bureaucratization of professional nurses, high clerical ratio, high degree of role definition, low decentralization from physicians and high decentralization from the headnurse. No comprehensive explanation could be provided

for why hospital X should have been different except that it was a relatively new teaching hospital attached to a new medical school.

Overall, the findings of relationships between the hospital characteristics and subunit structure were consistent with previous research examining organizational context; however, the findings of this study should be interpreted with caution because of the small number of hospitals (n = 24) included in the research and the lack of controlled sampling.

The results concerning relationships between the immediate perceived environment and the subunit's structure were somewhat disappointing in that no strong support was provided for the arguments in the literature that suggest that environment is an important factor in determining structure. No significant non-linear relationships were observed; however some linear relationships were found. For example, the complexity of physicians interacting with the subunit was found to be most strongly related to the type of decision-making apparent in the subunit. The pervasiveness of physicians into the subunit was strongly associated with structural complexity when this was measured by the R.N. ratio and the degree of bureaucratization of professional nurses. The complexity and pervasiveness of other groups and departments in the hospital was found to be relatively independent from the nursing subunit structure. The degree of subunit autonomy provided the most encouraging results in terms of subunit-environment relationships. Autonomy from administration was found to be significantly related to all three measures of structural complexity and to the degree of decentralization from the physicians.

From the analysis presented in this chapter it was not possible to evaluate the relative importance of the separate contingency variables for subunit structure or how these variables might combine to interact with measures of structure. These two factors form the basis for analysis presented in Chapter VI.

CHAPTER VI

RELATIVE IMPORTANCE OF TECHNOLOGY, SIZE AND ENVIRONMENT FOR STRUCTURE

The results presented in this chapter are concerned with exploring the relationships amongst the measures of technology, size, and environment and with assessing the relative importance of these variables for explaining variance in subunit structure.

The relationships between technology, size and environment were examined by using Pearson correlation coefficients with a level of significance of 0.01.

Stepwise regression analysis was employed to assess the relative importance of the contingency variables for explaining variance in nursing subunit structure. The aim in this analysis was to reduce the range of contingency variables to a smaller parsimonious group which could explain a reasonable proportion of variance in each of the dimensions of structure. Judgement concerning the relative importance of the contingency variables was made on the basis of three criteria: first, the proportion of variance explained by each independent variable as it entered the regression equation; second, the significance ($\alpha = 0.05$) of the regression coefficients of each additional contingency variable entering the regression equation; and third, the relative sizes of the standardized regression coefficients associated with each independent variable.

Relationships Amongst the Measures of Technology, Size, and Environment

Because of the lack of inclusion in previous research of a comprehensive range of contingency variables the relationships between

technology, size and environment have not been extensively investigated. Five hypotheses (5.1 to 5.5) were developed for relationships amongst these variables.

First, it was hypothesized that nursing subunits with uncertain, unstable, and variable technologies would be located in more complex secondary environments. Technological instability was found to be correlated 0.2653 with hospital size and 0.3075 with hospital structural differentiation (Table 32). These relationships implied that nursing subunits with unstable technologies tended to be located in large hospitals with a greater number of functional departments. Neither technological uncertainty nor variability were significantly related to any of the hospital variables which suggested that nursing subunits with uncertain and variable technologies were not located in one particular type of hospital context.

Second, it was proposed that subunits with unstable, uncertain, and variable technologies would be associated with complex and pervasive immediate environments, and low subunit autonomy. Instability in the technology correlated 0.6124 with the degree of pervasiveness of physicians into the subunit (Table 33). This finding implied a strong association between instability in nursing technology and the need for medical involvement in patient care. In addition, instability in the technology was correlated 0.2784 with the degree of pervasiveness of other groups and departments of the hospital into the subunit which implied that instability in nursing technology also required considerable involvement of paramedical, clinical and hotel services in the hospital. Instability in the nursing technology was not found to be associated with the complexity of the environment or

Table 32

Relationships Between Secondary Environment and Technology

Pearson Correlation Coefficients

Secondary Environment	Technology: Instability	Uncertainty	Variability
Hospital Size	0.2653* (156)[a]	0.1190 (156)	-0.0829 (156)
Teaching Status	0.13229 (156)	0.04215 (156)	0.04455 (156)
Structural Differentiation	0.3075* (156)	0.0362 (156)	0.0057 (156)
Community Size	0.1546 (156)	0.0805 (156)	-0.0535 (156)

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

Table 33

Relationships Between Immediate Environment and Technology

Pearson Correlation Coefficients

	Immediate Environment					
	Autonomy		Complexity		Pervasiveness	
Technology	Med	Admin	Med	Other	Med	Other
Instability	0.0143	0.0779	-0.0158	-0.0423	0.6124*	0.2784*
	(151)[a]	(149)	(151)	(152)	(144)	(144)
Uncertainty	0.0972	0.1421	-0.2111*	0.1720	0.1676	-0.2315*
	(151)	(149)	(151)	(152)	(144)	(144)
Variability	-0.0798	-0.0570	0.2781*	0.3237*	0.0679	0.2088*
	(151)	(149)	(151)	(152)	(144)	(144)

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

the autonomy of the subunit.

Uncertainty in the technology of the nursing subunit correlated -0.2111 with complexity of physicians in the environment and -0.2315 with the pervasiveness of other groups and departments (Table 33). These relationships suggested that in nursing subunits with uncertainty in the nursing technology there was a tendency for only a small group of physicians of the same speciality to interact with the subunit and there was little need for involvement of paramedical, clinical and hotel services.

Variability in the technology was correlated 0.2781 with the complexity of physicians in the environment and 0.3227 with the complexity of other groups interacting with the subunit. In addition, variability also correlated 0.2088 with the pervasiveness of other groups and departments (Table 33). These results implied that nursing subunits with variability in the technology tended to also rely upon a variety of physicians and other services to be involved in providing patient care.

Neither uncertainty nor variability in the technology were significantly related to the degree of autonomy of the subunit.

Three hypotheses were outlined for the relationships of technology and environment to subunit size. It was proposed that smaller subunits would be located in more complex secondary environments. As illustrated in Table 34, this hypothesis was to some degree supported by negative correlations between subunit size and hospital size (-0.2040), teaching status (-0.2258), and structural differentiation (-0.2444).

Table 34

Relationships of Secondary Environment, Immediate Environment and Technology to Subunit Size Pearson Correlation Coefficients

	Subunit Size
Secondary Environment:	
Hospital size	-0.2040* (156)[a]
Teaching Status	-0.2258* (156)
Structural Differentiation	-0.2444* (156)
Community Size	-0.0200 (156)
Immediate Environment:	
Autonomy - Med	0.0950 (151)
Autonomy - Admin	-0.0035 (149)
Complexity - Med	-0.0034 (151)
Complexity - Other	0.0653 (152)
Pervasiveness - Med	-0.2911* (144)
Pervasiveness - Other	-0.1595 (144)
Technology:	
Instability	-0.2950* (155)
Uncertainty	-0.1903* (155)
Variability	-0.0085 (155)

*Indicates significant at 0.01 level.

[a]Numbers in parentheses indicate number of subunits responding to all items employed in the measures.

It was also suggested that nursing subunits characterized by technological instability, uncertainty, and variability would be smaller in size. Some support for this hypothesis was provided by the negative correlations between subunit size and instability (-0.2950) and uncertainty (-0.1903).

The last hypothesis in this series proposed that small subunits would have less autonomy and be located in more complex and pervasive immediate environments. This hypothesis was not supported apart from a negative correlation of -0.2911 between size and medical pervasiveness (Table 34).

Stepwise regression analysis was used to attempt to explain variance in subuni size by using the three measures of technology and ten measures of the environment. The assumption underlying this procedure was that the size of nursing subunits might be a logical outcome of decisions concerning technology and the needs of the subunit to interact with the environment. A total of 27.03 percent of the variance in subunit size could be explained by the combined 13 measures of technology and environment.

The first five variables entering the regression model had significant (α = 0.05) regression coefficients and produced an R square of 0.24185. Analysis of variance showed that this R square was significantly different from zero with an F. value of 8.07736 (D.F. regression 5, residual 127, F. prob. 0.0000). The standard error of the estimate was 11.31029.

The order of the five variables in explaining variance in subunit size is shown in Table 35. The first variable, explaining 10.208 percent of the variance in subunit size, was the degree of pervasive-

Table 35

Stepwise Regression to Explain Variance in Subunit Size Using Technology, Secondary Environment and Immediate Environment[a]

Contingency Variables[b]	Multiple R	R Square	Regression Coefficient	SE	Standardized Regression Coefficient
Immediate Environment (Pervasiveness - Med)	0.3195	0.1021	-0.526	0.230	-0.189
Secondary Environment (Teaching Status)	0.3850	0.1482	-7.287	3.217	-0.287
Secondary Environment (Community Size)	0.4318	0.1865	7.891	2.309	0.422
Secondary Environment (Struct.Differentiation)	0.4617	0.2132	-0.785	0.347	-0.308
Technology (Uncertainty)	0.4912	0.2413	-2.179	1.004	-0.172
Constant			37.522		

[a] $n = 133$.

[b] Only those variables with significant ($\alpha = 0.05$) regression coefficients have been presented.

ness of medical staff into the subunit. Three variables measuring the secondary environment followed. Teaching status of the hospital added a further 4.614 percent of variance; community size added a further 3.824 percent of variance, and structural differentiation provided an additional 2.67 percent of variance in subunit size. The last significant variable was uncertainty in the technology which accounted for an additional 2.813 percent of the variance.

Instability in the technology did not emerge from the stepwise regression analysis as an important predictor of subunit size. It was suspected that the variance in subunit size explained by instability probably overlapped with the variance explained by pervasiveness of physicians since these variables were relatively high correlated.

It may be noted from Table 35 that the standardized regression coefficients of the secondary environment variables were greater than those observed for pervasiveness of physicians; the order of the independent variables entering the regression analysis, however, indicated that the secondary environment was only of such importance to subunit size once the pervasiveness of physicians had been taken into consideration.

In summary, the examination of intercorrelations amongst the measures of technology, size and environment indicated that there were some significant relationships and that these variables could not and should not be considered independent phenomena. The relationships between technology and subunit environment, quite clearly, depended upon how technology was measured. Instability in the technology was strongly related to the pervasiveness of physicians into the subunit and was

also associated with hospital size and structural differentiation. Uncertainty and variability in the technology were not associated with the characteristics of the hospital but were correlated with the complexity of physicians and the pervasiveness of other departments interacting with the subunit.

About 24 percent of the variance in subunit size could be accounted for by five combined measures of technology and environment. The degree of pervasiveness of physicians into the subunit was the most important contributor to explaining variance in subunit size followed by hospital size, teaching status, and structural differentiation. Because of the relatively low proportion of variance in subunit size accounted for by the contingency variables as a whole, it must be concluded that there are many factors contributing to decisions concerning the size of nursing subunits which were not measured in this study.

Relative Importance of Contingency Variables for Structural Complexity

As a general guide to this analysis it was hypothesized that high structural complexity in nursing subunits would be associated with high technological uncertainty, instability and variability, small subunit size, high complexity of the secondary and immediate environments, high pervasiveness of the immediate environment and low subunit autonomy.

It was expected that some of the measures of technology, size and environment would be more important than others for explaining variance in structural complexity and on the basis of research by Child (1973) it was hypothesized that size would be the most important predictor

of structural complexity. Some empirical support for a relationship between size and structural complexity had been shown in the bivariate analysis in Chapter V; however, it had not been possible to assess the relative importance of size when several of the contingency variables were considered simultaneously. Accordingly, stepwise regression was used in order to identify the most parismonious combination of measures of technology, size and environment for explaining variance in structural complexity. Separate regression analyses were performed for each of the three indicators of structural complexity, that is, the R.N. ratio, bureaucratization of professional nurses and the clerical ratio. In each of the analyses, the three measures of technology, one measure of size and ten measures of the environment were allowed to enter the regression equation initially. In addition, four dummy hospital variables were created and entered into the regression model; these were dummy variables for 1) the chronic hospital, 2) the psychiatric hospital, 3) small rural hospitals (less than 200 beds), and 4) hospital X. Initially, therefore, 18 independent variables were entered into the regression model to explain variance in the three measures of structural complexity.

R.N. Ratio

Using all 18 independent variables in the regression analysis, a total of 65.75 percent of the variance in the R.N. ratio could be accounted for. Four of the contingency variables produced an R square of 0.47387 (Table 36) with a standard error of 0.14159. Analysis of variance indicated that the R square was significantly different from zero with an F. value of 27.47013 (D.F. regression 4, residual 122; F. prob. 0.0000). The first four contingency variables were the only

Table 36

Stepwise Regression to Explain Variance in Structural Complexity[a]

Contingency Variables[b]	Mult R	R Square	Regression Coefficient	SE	Standardized Regression Coefficient
Predicting R.N. Ratio:					
Subunit Size (No. of Beds)	0.5012	0.2512	-0.006	0.001	-0.362
Technology (Instability)	0.6250	0.3906	0.052	0.016	0.265
Immed.Envir.(Autonomy-Admin)	0.6737	0.4538	0.006	0.002	0.231
Immed.Envir.(Pervasiveness-Med)	0.6884	0.4739	0.008	0.004	0.182
Constant			0.382		
Predicting Bureaucratization of Prof. Nurses:					
Secondary Envir.(Chronic Hosp.)	0.6474	0.4191	0.329	0.051	0.448
Secondary Envir.(Psych.Hosp.)	0.7096	0.5036	0.199	0.047	0.243
Subunit Size (No. of Beds)	0.7417	0.5501	0.003	0.001	0.201
Secondary Envir.(Location)	0.7538	0.5682	0.118	0.024	0.426
Secondary Envir.(Str.Diff.)	0.7840	0.6147	-0.013	0.003	-0.367
Immed.Envir.(Autonomy-Admin)	0.8002	0.6404	-0.004	0.001	-0.167
Constant			-0.081		
Predicting Clerical Ratio:					
Clerical'(Subunit Size)	0.4029	0.1623	1.205	0.183	0.517
Secondary Envir.(Hosp. X)	0.5284	0.2792	0.036	0.010	0.293
Secondary Envir.(Hosp. Size)	0.5865	0.3440	0.001	0.001	0.488
Immed.Envir.(Autonomy-Admin)	0.6377	0.4067	0.001	0.001	0.292
Technology (Instability)	0.6615	0.4375	0.012	0.003	0.328
Immed.Envir.(Pervasiveness-Med)	0.6797	0.4620	-0.002	0.001	-0.219
Secondary Envir.(Teaching)	0.6944	0.4822	-0.022	0.010	-0.328
Constant			-0.033		

[a] n = 127.

[b] Only those variables with significant ($\alpha = 0.05$) regression coefficients have been presented.

independent variables with significant ($\alpha = 0.05$) regression coefficients. The proportion of variance in R.N. ratio explained by the first four contingency variables is shown in Table 36. The first variable entering the regression analysis was subunit size which explained 25.123 percent of the variance in the R.N. ratio. Instability in the technology explained an additional 13.939 percent of variance. The degree of autonomy from administration, a measure of the subunit's interaction with the immediate environment, was responsible for a further 6.321 percent of variance in the R.N. ratio. The fourth independent variable was the degree of pervasiveness of physicians into the subunit which explained an additional two percent of variance.

From this analysis it was concluded that subunit size was the best single predictor of the R.N. ratio when the criteria of the proportion of variance explained and the size of the standardized regression coefficient were used. From Tables 23 and 24 (Chapter V) it can be noted that instability in the technology had a marginally greater correlation (0.5282) with the R.N. ratio than subunit size (-0.4726). The multiple regression analysis, however, was based upon an n of 127 which produced an increase in the correlation between subunit size and the R.N. ratio to -0.50123 and a decrease in the correlation between instability and the R.N. ratio to 0.49705.

Together, size, instability in the technology, autonomy from administration, and pervasiveness of physicians accounted for about 47 percent of the variance in the R.N. ratio which was considered a reasonably high proportion of variance explained. Two contingency variables which had significant (0.01) correlations with the R.N.

ratio did not emerge from the stepwise analysis as being relatively important factors in determining the R.N. ratio over and above the four variables already described; these variables were uncertainty in the technology and the degree of structural differentiation of the hospital. Both these variables were significantly correlated with subunit size and instability in the technology which could account for their absence in the stepwise analysis. None of dummy hospital variables (chronic, psychiatric, rural or hospital X) appeared as important predictors of the R.N. ratio.

Bureaucratization of Professional Nurses

The same 18 independent variables were used to attempt to explain variance in the degree of bureaucratization of professional nurses within each subunit. The total amount of variance that could be accounted for by all 18 variables was 66.844 percent. The first six independent variables entering the stepwise regression produced an R square of 0.6404 with a standard error of 0.11596. Analysis of variance indicated that the R square was significant resulting in an F. value of 35.61036 (D.F. regression 6, residual 120; F. prob. 0.0000). These six independent variables were the only contingency variables with significant ($\alpha = 0.05$) regression coefficients.

As illustrated in Table 36, the dummy variables of chronic hospital and psychiatric hospital were the first two variables to enter the regression equation in predicting the degree of bureaucratization of professional nurses. These two variables accounted for over 50 percent of the variance in bureaucratization of professional nurses. The third variable entering the equation was subunit size which added a further 5 percent to the variance explained. Two measures of the secondary

environment (community size and structural differentiation) and a measure of the immediate environment (autonomy from administration) made further small contributions to the amount of variance in bureaucratization of professional nurses which could be accounted for.

In conclusion from this analysis, although subunit size was an important predictor of the degree of bureaucratization of professional nurses as expected from the correlation coefficient of 0.5307 (Table 24), the type of hospital in which the subunit was located was a more important factor in explaining variance using the stepwise approach; whether or not the subunit was located in the chronic hospital or the psychiatric hospital in this study were the most important determinants of the level of bureaucratization of professional nurses.

Clerical Ratio

Because of the nonlinear relationship between the clerical ratio and the number of subunit beds (described in Chapter V) a new variable was created for use in predicting the clerical ratio by stepwise regression using a second degree polynomial as follows:

$$\text{clerical}' = (-0.11875) + (-0.00582 \times \text{subunit size}) + (0.0643 \times \text{subunit size-squared})$$ [1]

Using stepwise regression, an attempt was made to explain variance in the clerical ratio using the same 18 independent variables used for explaining variance in the other measures of structural complexity; however, for this analysis subunit size was replaced by the new variable clerical'.

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[1] See Table 26 (Chapter V).

The 18 independent variables accounted for a total of 51.801 percent of the variance in the clerical ratio. The first seven contingency variables produced an R square of 0.48215 with a standard error of 0.0250. Analysis of variance showed that this R square was significantly different from zero with an F. value of 15.82833 (D.F. regression 7, residual 119; F. prob. 0.0000).

The first variable entering the regression equation in predicting the clerical ratio was clerical'. This variable accounted for over 16 percent of the variance in the clerical ratio. The second variable was the dummy variable for hospital X; the influence of the uniqueness of hospital X in relation to the clerical ratio accounted for about 12 percent of the variance in the clerical ratio. The importance of these two variables for the clerical ratio was not unexpected given the discussion of the nature of the relationships amongst these variables in Chapter V. The third variable of importance to the clerical ratio was hospital size. Again, this finding was to be anticipated given earlier analysis. The degree of autonomy from administration was the fourth variable entering the regression equation and this variable accounted for about 6 percent more of the variance in the clerical ratio. The last three variables with significant regression coefficients entering the stepwise regression model were instability in the technology, pervasiveness of physicians in the immediate environment and the teaching status of the hospital. Quite clearly, these variables made smaller but important contributions to explaining variance in the clerical ratio.

In conclusion from this analysis, the size of the subunit was the most important predictor of the clerical ratio. In general, however,

the characteristics of the secondary environment, as measured by the uniqueness of hospital X, hospital size and teaching status, were important in explaining variance in the clerical ratio. In addition, the two measures of the immediate environment, autonomy from administration and pervasiveness of physicians, along with instability in the technology, further contributed to explaining variance in the clerical ratio.

In summary, from the analysis to assess the relative importance of technology, size and environment for explaining variance in structural complexity in nursing subunits, strong support was provided for the hypothesis that size was the most important predictor. These findings were consistent with the research of Child (1973). Subunit size appeared in the current study as the single most important predictor of the R.N. ratio and the clerical ratio and the third most important factor for the degree of bureaucratization of professional nurses. In general, the R.N. ratio appeared to be best predicted by subunit size and selected measures of technology and the immediate environment; these variables explained over 47 percent of the variance in the R.N. ratio. In contrast, the degree of bureaucratization of professional nurses was best predicted by the characteristics of the hospital as a whole, i.e., the secondary environment. Quite clearly, the type of hospital, its location and structural differentiation were important factors in determining bureaucratization of professional nurses; these variables accounted for over 64 percent of the variance. The clerical ratio, however, was best predicted by subunit size in addition to hospital size and the unique characteristics of hospital X; as for the other contingency measures, autonomy from administration

was an important factor along with instability in the technology and pervasiveness of physicians. Overall, about 48 percent of the variance in the clerical ratio could be accounted for.

Relative Importance of Contingency Variables for Formalization

On the basis of research of Child (1973) it was expected that structural complexity would contribute to the explanation of variance in formalization in addition to the contributions made by technology, size and environment. Accordingly, the guiding hypothesis for this analysis suggested that high formalization would be associated with low structural complexity, low technological instability, uncertainty and variability, large subunit size, low complexity in the secondary and immediate environments, low pervasiveness of the immediate environment and high subunit autonomy. It was anticipated that some variables would be more important than others for explaining variance in formalization. From the bivariate analysis and from the experience of Child (1973) it was expected that structural complexity when measured by the clerical ratio would be the most important predictor of role definition and when measured by the R.N. ratio would be the most important predictor of role specificity. Stepwise regressional analysis was, therefore, used to attempt to explain variance in role definition and role specificity using the 18 contingency variables and three structural complexity variables (n = 21 independent variables).

Role Definition

Using all 21 independent variables it was possible to explain 49.389 percent of the variance in role definition. The first four of the 21 variables had significant ($\alpha = 0.05$) regression coefficients and these produced an R square of 0.4308 with a standard error of

2.6036. Analysis of variance indicated that the R square was significantly different from zero with an F. value of 23.08653 (D.F. regression 4, residual 122; F. prob. 0.0000).

As illustrated in Table 37, the most important single predictor of the extent of role definition was whether or not the subunits were located in hospital X. This variable accounted for over 16 percent of the variance in the degree of role definition. Hospital size was the second most important variable explaining an additional 10 percent of the variance in role definition. Although the clerical ratio had been expected to appear as the single best predictor of role definition, this variable appeared third accounting for an additional 12 percent of the variance over and above the influences of hospital X and hospital size. The fourth variable with a significant regression coefficient was the degree of structural differentiation of the hospital; this variable explained a further 4 percent of the variance in role definition over and above the first three variables in the equation.

These results showed quite clearly the importance of the secondary environment, i.e., the characteristics of the hospital as a whole, for determining the extent to which written documents were available to nurses within each subunit.

<u>Role Specificity</u>

Only 28.654 percent of the variance in role specificity could be accounted for by all the 21 independent variables. The first six contingency variables had significant regression coefficients and were responsible for 23.735 percent of the variance. This R square was significantly different from zero with an F. value of 6.92347 (D.F.

Table 37

Stepwise Regression to Explain Variance in Formalization[a]

Contingency Variables[b]	Mult R	R Square	Regression Coefficient	SE	Standardized Regression Coefficient
Predicting Role Definition:					
Secondary Envir. (Hosp. X)	0.4055	0.1645	2.955	0.967	0.235
Secondary Envir. (Hosp. Size)	0.5140	0.2642	- 0.006	0.001	-0.691
Struc. Complex. (Clerical Ratio)	0.6266	0.3926	38.796	7.913	0.386
Secondary Envir. (Str. Diff.)	0.6564	0.4308	0.227	0.079	0.335
Constant			13.970		
Predicting Role Specificity:					
Struct. Complex. (R.N. Ratio)	0.3293	0.1084	- 3.406	0.750	-0.423
Technology (Uncertainty)	0.3743	0.1401	- 0.139	0.127	-0.148
Secondary Envir. (Teaching)	0.4129	0.1705	0.635	0.240	0.221
Immed. Envir. (Complex.-Other)	0.4438	0.1969	- 0.080	0.030	-0.202
Immed. Envir. (Perv.-Other)	0.4717	0.2224	0.059	0.029	0.203
Immed. Envir. (Complex.-Med.)	0.4872	0.2374	0.038	0.025	0.187
Constant			17.106		

[a] $n = 127$.

[b] Only those variables with significant ($\alpha = 0.05$) regression coefficients have been presented.

regression 6, residual 120; F. prob. 0.0000). The standard error was 1.27816.

As illustrated in Table 37, the most important variable for explaining variance in role specificity was the R.N. ratio which accounted for 10.844 percent of the variance. Technological uncertainty was responsible for a further 3.169 percent; teaching status of the hospitals for 3.040 percent; complexity of other groups and departments in the hospital for 2.639 percent; pervasiveness of other groups and departments in the hospital for 2.553 percent; and complexity of physicians in the environment accounted for a further 1.49 percent of the variance in role specificity.

On the basis of the Pearson correlation coefficients (Table 24) subunit size had been weakly related to role specificity ($r = 0.1902$); however, size did not emerge as an important predictor of role specificity in the stepwise analysis. In addition, on the basis of single correlations, teaching status of the hospital, complexity and pervasiveness of other groups and departments and complexity of physicians were not significantly related either at the 0.01 or 0.05 levels to role specificity. From the stepwise analysis, nevertheless, these variables marginally increased the variance in role specificity explained over and above the contributions of the R.N. ratio and the uncertainty in the technology. The type of hospital or other characteristics of the secondary environment did not appear as important factors for the degree of role specificity within nursing subunits.

Overall, these attempts to explain variance in formalization provided some support for the work of Child (1973) which had shown that structural complexity was a more important predictor of formaliza-

tion than size. This current study, however, indicated that the structural complexity variables of importance depended upon how formalization was measured. When formalization was measured in terms of role definition (number of written documents) then the clerical ratio was somewhat important; when formalization was measured by role specificity (nurses' perceptions of rules and regulations) then the proportion of nursing staff with professional level education was important.

A reasonable proportion of variance in role definition (over 43 percent) could be explained by four contingency variables. Quite clearly, however, the characteristics of the secondary environment as measured by hospital size, structural differentiation, and the uniqueness of hospital X were important variables in determining the extent to which written documents were available.

Less than 24 percent of the variance in role specificity could be explained by six contingency variables. The R.N. ratio was responsible for the greatest amount of variance followed by technological uncertainty and teaching status of the hospital. Measures of the immediate environment, in terms of the complexity and pervasiveness made small additional contributions to the explanation of variance in role specificity. The characteristics of the secondary environment did not appear to be important for determining the degree of role specificity within the subunit.

<u>Relative Importance of Contingency Variables for Decentralization</u>

It was hypothesized that, in general, high decentralization in decision-making would be associated with high structural complexity, high technological uncertainty, instability and variability, small subunit size, high complexity in the secondary and immediate environ-

ments, high pervasiveness of the immediate environment and low subunit autonomy. It had also been proposed on the basis of Child's research (1973) that size would be the most important predictor of decentralization; however, from the correlation analysis presented in Table 24, it was clear that subunit size was not significantly related to decentralization. From the bivariate analysis it was expected that uncertainty in the technology would be the most important single predictor of decentralization from the headnurse and the complexity of physicians interacting with the subunit would be the most important factor in decentralization from physicians.

The same 21 independent variables used to explain variance in formalization were used to attempt to explain variance in the two measures of decentralization.

Decentralization from Physicians

A total of 44.138 percent of the variance in decentralization from physicians could be accounted for by the 21 independent variables. Six variables, the only contingency variables with significant ($\alpha = 0.05$) regression coefficients, produced an R square of 0.3716 with a standard error of 0.77255. Analysis of variance showed that this R square was significantly different from zero with an F. value of 11.82643 (D.F. regression 6, residual 120; F. prob. 0.0000).

As illustrated in Table 38, the variable accounting for the largest amount of variance in the degree of decentralization from physicians was the complexity of physicians in the subunit's immediate environment which explained 11.578 percent of the variance. An additional 12 percent of the variance in decentralization from physicians was accounted for by whether or not the subunit was located in hospi-

Table 38

Stepwise Regression to Explain Variance in Decentralization[a]

Contingency Variables[b]	Mult R	R Square	Regression Coefficient	SE	Standardized Regression Coefficient
Predicting Decentralization from Physicians:					
Immed.Envir.(Complex-Med.)	0.3403	0.1158	0.094	0.015	0.479
Secondary Envir.(Hospital X)	0.4865	0.2367	- 0.883	0.268	-0.251
Struct.Complex.(R.N. Ratio)	0.5560	0.3092	- 1.593	0.422	-0.322
Secondary Envir.(Chronic Hosp.)	0.5756	0.3313	- 0.664	0.299	-0.180
Technology (Variability)	0.5922	0.3507	- 0.169	0.078	-0.168
Immed.Envir.(Autonomy-Admin.)	0.6096	0.3716	- 0.021	0.010	-0.157
Constant			7.812		
Predicting Decentralization from the Headnurse:					
Technology (Uncertainty)	0.3439	0.1183	0.278	0.111	0.198
Secondary Envir.(Hospital X)	0.4167	0.1737	1.189	0.407	0.225
Immed.Envir.(Complex.-Med.)	0.4687	0.2196	- 0.096	0.024	-0.326
Struct.Complex.(Bureauc.of Prof.)	0.5182	0.2685	- 1.829	0.581	-0.241
Technology (Variability)	0.5598	0.3134	0.351	0.120	0.231
Immed.Envir.(Autonomy-Med.)	0.5792	0.3355	0.086	0.043	0.151
Constant			14.509		

[a] n = 127.

[b] Only those variables with significant ($\alpha = 0.05$) regression coefficients have been presented.

tal X. The third variable of importance for explaining variance in the extent of decentralization is decision-making from physicians was the R.N. ratio; this variable accounted for an additional 7 percent of the variance. Whether or not the subunit was located in the chronic hospital in the study was also an important factor along with the degree of technological variability and autonomy from administration. The latter three variables entering the regression equation each added incrementally between 2-3 percent of the variance explained in decentralization from physicians.

From the bivariate analysis shown in Table 23, it was expected that instability and uncertainty in the technology would have important influences upon the degree of decentralization from physicians. From the stepwise analysis, these variables did not emerge as important, however, this finding was probably due to their correlation with the complexity of physicians in the immediate environment. In general, it would seem from this analysis of contingencies contributing to the explanation of variance in decentralization from physicians that a wide variety of factors were important including the number and variety of physicians involved with the subunit, the policies of an individual hospital, the extent to which professional nurses were employed and the type of nursing technology.

Decentralization from the Headnurse

The 21 independent variables accounted for a total of 43.325 percent of the variance in decentralization of decision-making from the headnurse. The first six variables produced an R square of 0.3355 with a standard error of 1.19582. Analysis of variance indicated that the R square was significantly different from zero with an F. value of

10.09623 (D.F. regression 6, residual 120; F. prob. 0.0000).

The most important variable for explaining variance in the degree of decentralization of decision-making from the headnurse was technological uncertainty which accounted for 11.827 percent of the variance (Table 38). Uncertainty was followed by the influence of whether or not the subunit was located in hospital X; this variable accounted for an additional 5 percent of the variance in decentralization of decisions from the headnurse. The complexity of physicians in the environment was the third variable entering the regression equation to explain variance in decentralization from the headnurse and this variable explained approximately 5 percent of the variance over and above the first two variables. The degree of bureaucratization of professional nurses was also an important variable in determining decentralization along with technological variability and the degree of autonomy from physicians.

In general, then, the degree of decentralization of decisions from the headnurse was influenced by a combination of technological factors (uncertainty and variability), the complexity of physicians in the immediate environment and the extent to which professional nurses were employed in bureaucratic leadership positions. The unique characteristics of hospital X were also important for determining the degree of decentralization from the headnurse. Overall, however, decentralization from the headnurse was not strongly influenced by the characteristics of the secondary environment, such as, hospital size, structural differentiation, teaching status or community size.

In summary, no support was provided for the hypothesis suggested by Child (1973) that size was an important variable in determining the degree of decentralization of decision-making. It will be recalled that the two measures of decentralization in this study were correlated -0.5563 and, quite clearly, from the stepwise regression analysis some of the same contingency variables were important for explaining variance in decentralization from physicians and decentralization from the headnurse; these were the complexity of physicians in the subunit environment, the uncertainty or variability in the technology and the autonomy of the subunit. The order of importance of the contingency variables was different for the two measures of decentralization. Complexity of physicians in the environment explained the greatest amount of variance in decentralization of decision from physicians, whereas, uncertainty in the technology accounted for the most variance in decentralization from the headnurse. Measures of structural complexity appeared to be significant factors in both instances, in explaining variance in decentralization. In addition, whether or not the subunits were located in hospital X was an important factor to both decentralization from physicians and decentralization from the headnurse.

Overall, about 37 percent of the variance in decentralization from physicians and 34 percent of the variance in decentralization from the headnurse could be accounted for by six contingency variables each. Although the proportion of variance accounted for was not high, given that decentralization was measured by the nurses' perceptions of the subunit's behavior, the results were perhaps as high as could realistically be expected.

Conclusions

The results presented at the beginning of the chapter were concerned with evaluating the interrelationships amongst the measures of technology, environment, and size of nursing subunits. Previous research has tended to consider these contingency variables as independent factors in their interactions with structure or has not generally included a comprehensive range of measures so that their interrelationships could be explored (Ford and Slocum, 1977).

It was first hypothesized that nursing subunits with indeterminant technologies would be located in large, urban, teaching hospitals with high structural differentiation. Some support for this hypothesis was provided when indeterminancy in the technology was measured by the degree of instability. These findings must, however, be interpreted with caution because of the lack of systematic control in selecting hospitals and subunits for inclusion in the study.

It was also proposed that nursing subunits with indeterminant technologies would be situated in immediate environments characterized by high complexity and pervasiveness and that they would have low autonomy from their environments. The extent of confirmation of this hypothesis depended upon how indeterminancy in the technology was measured. Subunits with unstable technologies tended to be associated with a high degree of pervasiveness of physicians and other groups and departments into the subunit. Subunits with uncertain and variable technologies tended to be associated with immediate environments characterized by heterogeneity in both physicians and other groups and departments interacting with the subunits. The degree of autonomy of the subunit did not appear to be associated with a particular type of

technology.

It was suggested that, in general, small nursing subunits would be located in more complex hospitals, have more complex and pervasive environments and more indeterminant technologies. To some degree, this hypothesis was confirmed in that negative associations were found between subunit size and the size, structural differentiation, location and teaching status of the hospital; negative relationships were also found between the degree of medical pervasiveness, instability and uncertainty in technology, and subunit size. About 24 percent of the variance in subunit size could be accounted for by the degree of medical pervasiveness, characteristics of the hospital, and uncertainty in the technology. The importance of these findings must be interpreted with caution because of the lack of systematic sampling of hospitals and subunits and because about 75 percent of the variance in subunit size could not be accounted for by contingencies measured in this study.

The main conclusion drawn from the examination of the interrelationships amongst the measures of technology, size and environment was that these contingency factors could not and should not be viewed as independent phenomena.

The second part of the chapter was concerned with the presentation of analysis performed to examine the relative importance of the measures of technology, size, and environment for explaining variance in structure. The aim in this analysis was to find out how the contingency variables combined in their interactions with nursing subunit structural complexity, formalization, and decentralization. Stepwise regression analysis was used.

It was hypothesized that size would be the most important predictor of structural complexity (Child, 1973) and relatively strong support was provided for this hypothesis. When structural complexity was measured by the R.N. ratio and by the clerical ratio, subunit size explained the most variance. When structural complexity was measured by the degree of bureaucratization of professional nurses, subunit size was the third variable to enter the stepwise regression analysis.

In general, a relatively large proportion of variance in the structural measures could be accounted for by the various contingency variables. About 47 percent of the variance in the R.N. ratio could be accounted for by subunit size, measures of technology and measures of the immediate environment. The characteristics of the secondary environment did not appear as important factors for the R.N. ratio. Approximately 64 percent of the variance in the degree of bureaucratization of professional nurses could be accounted for by the characteristics of the secondary environment such as, hospital type, location and structural differentiation along with subunit size. The clerical ratio within the subunit was best explained by subunit size with hospital size, teaching status, the uniqueness of hospital X, technological instability and pervasiveness of physicians also contributing; these variables accounted for about 42 percent of the variance in the clerical ratio.

It was also hypothesized that structural complexity was the most important predictor of formalization (Child, 1973). Some evidence was provided to support this hypothesis; the R.N. ratio was the most important single predictor of role specificity and combined with un-

certainty in the technology, teaching status of the hospital and three measures of the immediate environment to explain 24 percent of the variance.

When formalization was measured in terms of role definition, i.e., by the number of written documents available within the subunit, structural complexity as measured by the clerical ratio was important; in addition, however, the characteristics of the secondary environment, such as, hospital size and structural differentiation contributed to explaining variance in the clerical ratio. Also, whether or not the subunit was located in hospital X was a determinant of the size of the clerical ratio. Overall, a larger proportion of variance in role definition could be explained (43 percent) than could be explained in role specificity. This factor may have been because role definition was measured by a count of the number of documents available, whereas, role specificity was measured in a more abstract way by the nurses' perceptions of rules and regulations.

On the basis of Child's (1973) research it was hypothesized that size would be the most important predictor of decentralization. No support was provided for this hypothesis. The degree of decentralization from physicians was explained by the complexity of physicians interacting with the subunit, the R.N. ratio, autonomy from administration, and variability in the technology. The degree of decentralization in decision-making from the headnurse was predicted by the uncertainty in the subunit technology in combination with the complexity of physicians interacting with the subunit, the bureaucratization of professional nurses, variability in the technology and autonomy from physicians.

Whether or not the subunits were located in hospital X in this study was an important factor in determining both decentralization from physicians and decentralization from the headnurse.

As with the measure of role specificity, the degree of decentralization in decision-making had been measured by asking nurses' opinions. Only about 35 percent of the variance in the two measures of decentralization could be accounted for by the variables listed above; this amount was considerably less than the measures of structural complexity where more tangible measures were employed.

In general, the results of the stepwise regression analysis suggested that the contingency variables combined in a complex manner in their interactions with subunit structure. Some patterns were observable in the types of contingencies of importance in explaining variance in specific dimensions of structure and these patterns are discussed in detail in the next chapter.

CHAPTER VII

DISCUSSION OF RESULTS, CONCLUSIONS AND LIMITATIONS

In this chapter, the results of the study have been discussed in terms of their implications for the manner in which nursing subunits appear to accommodate to the various contingencies they face. Some conclusions have been drawn concerning the applicability of the contingency model for analysing nursing subunits. In addition, the main limitations of the study have been outlined and some suggestions made for further research.

Discussion of Results

The main purpose of this research was to explore the relationships between technology, size, environment, and structure in nursing subunits in hospitals. The rationale for the study was derived from the contingency approach to organizations which assumes that structural complexity and processes of bureaucratic control are reactions or adaptive strategies employed by organizations to accommodate to the contingencies they face. One advantage of using nursing subunits for the study was that they are clearly identifiable social units within hospitals which facilitates consistency in maintaining the unit of analysis at the subunit level.

Previous research employing the contingency approach to organizational analysis has tended to focus upon the exploration of relationships between a small number of contingencies and their effects upon structure. In human service organizations research has emphasized the relationships between technology, size, and structure and there has been little attention given to the effects of the environment of the

organization upon internal structure.

In keeping with previous research, the first part of this study focussed upon the exploration of the relationships between single contingencies and dimensions of structure. A total of three aspects of technology, one measure of subunit size, and 10 measures of the environment were examined separately for their interactions with sub-unit structural complexity, formalization, and decentralization. The findings from this analysis, presented in Chapter V, indicated that a complex pattern of relationships existed between the individual contingency variables and the measures of structure. In general, the type and strength of relationships observed, tended to depend upon which indicators of the contingencies and structure were employed. Consistent with previous research in human service organizations linear relationships were observed between technological uncertainty and instability and the extent to which professional nurses were employed. In addition, these aspects of technology were found to be related to measures of role specificity and decentralization in decision-making. Subunit size was also found to be associated with measures of structural complexity and role specificity. Subunit size was observed to be linearly related to the R.N. ratio, nonlinearly related to the clerical ratio, and both linearly and nonlinearly related to the degree of bureaucratization of professional nurses.

From the bivariate analysis, it appeared that the four measures of the secondary environment were moderately strongly related to the structural complexity within nursing subunits. Both hospital size and degree of structural differentiation were observed to have nonlinear relationships with the measures of subunit structural complexity. As

a consequence of examining nonlinear relationships between the hospital characteristics and subunit structural complexity, the importance of taking into consideration the type of hospital (acute general, rural, chronic and psychiatric) emerged. In addition, from this bivariate analysis, it was observed that subunits in one hospital in this study, namely, hospital X, had a different structural form than subunits in other hospitals.

There was no clear pattern of relationships observable between the six measures of the immediate environment and the measures of structural complexity, formalization, and decentralization although a number of linear relationships were found between single measures of the environment and structure. These findings were somewhat disappointing given the emphasis placed in current literature upon organization-environment relationships.

This initial bivariate analysis was useful in that it provided some information about how single contingencies interacted with different aspects of subunit structure. It also pointed out that contingency research which only takes into consideration a few contingency variables could be misleading by giving disproportionate emphasis to those relationships found as opposed to considering a range of rival possible explanations.

The second part of this research focussed upon identifying the relative importance of technology, size, and environment for explaining variance in subunit structure. The aim in this analysis was to find out which contingencies were important and how they combined to influence the development of nursing subunit structures. Taking each dimension of structural complexity, formalization, and decentralization

in turn, an attempt was made to explain variance in these dimensions using measures of technology, size, and environment. Stepwise regression analysis was used and the findings were presented in Chapter VI. Overall, this analysis indicated that the order of importance of the contingency variables in influencing subunit structure was different depending upon which measures of structure were employed.

Some patterns were identifiable in the types of contingencies which were important for specific aspects of subunit structure. These patterns or trends implied that the nursing subunits, to some extent, developed structures which reflected the types of contingencies they faced. By no means were these patterns either clearcut or simple; accordingly, it must be assumed that in real life any decisions concerning adaptive or reactive responses of nursing subunits to the various contingencies they face are based upon a rather complex set of circumstances.

Three main trends in structural adaptation to specific types of contingencies were observed. These trends were those associated with 1) increases in the proportion of professionally qualified nurses employed in nursing subunits; 2) increases in the degree of decentralization in decision-making; and 3) increases in the extent of written documentation available within the subunits.

In the following section these trends have been described in further detail, however, some caution is required in their interpretation because of the limitations associated with the use of stepwise regression for identifying the relative importance of the various contingencies for explaining variance in the dimensions of structure. First, there were some moderate relationships amongst the contingency

variables themselves which may have distorted their relative importance. Second, for some structural variables a relatively large proportion of the variance was unaccounted for which indicated that there were other factors outside the range of this study influencing the development of the structural forms in nursing subunits.

Contingencies Associated with Increases in the Proportion of Professional Nurses Employed

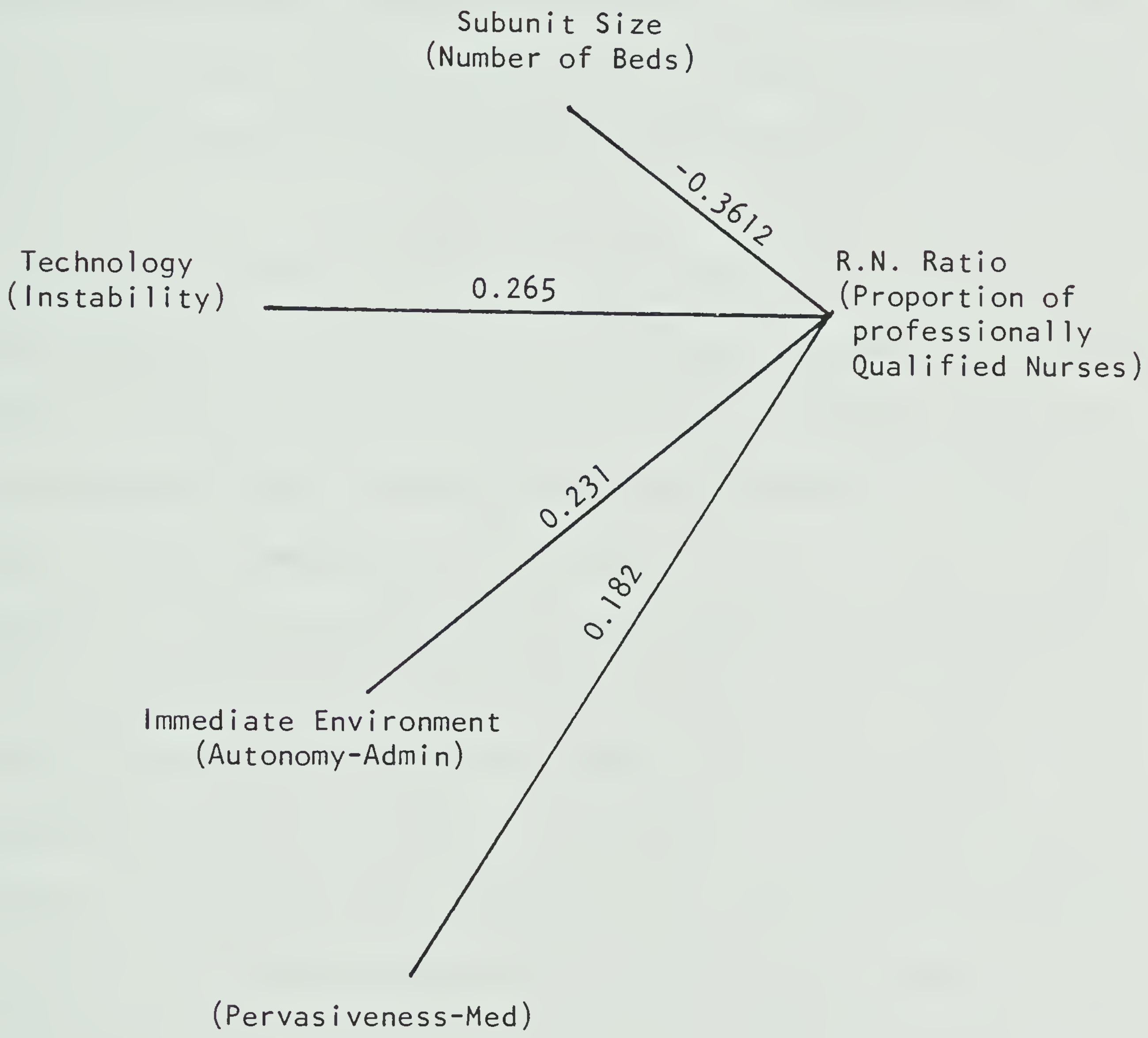
The contingencies identified through stepwise regression to be associated with increases in the proportion of professional nurses employed in the nursing subunits in this study are illustrated in Figure 1. Over 47 percent of the variance in the R.N. ratio was accounted for by four contingency variables: subunit size; instability in the technology; pervasiveness of physicians into the subunit; and the autonomy of the subunit from administration. The standardized regression coefficients resulting from the stepwise regression analysis have been included in Figure 1 to provide some indication of the relative weights of the four contingencies in their associations with the R.N. ratio.

Although the contingency variable of subunit size accounted for the largest proportion of variance in the R.N. ratio, the importance of subunit size as an influence on the proportion of professional nurses employed in the subunit must be viewed in the context of the other relevant contingency variables. The more important of these were the pervasiveness of physicians and the instability in technology. It will be recalled from the results presented in Chapter VI that the degree of pervasiveness of physicians was the most important single

Figure 1

Contingencies Associated with Increases in the Proportion of Professional Qualified Nurses Employed

Standardized Regression Coefficients[a]



[a]Variables of importance and standardized regression coefficients derived from stepwise regression presented in Chapter VI.

predictor of subunit size. Instability in the technology was also correlated with subunit size but did not appear from stepwise regression analysis as an important predictor of size because of its high correlation with the measure of pervasiveness of physicians. The most logical interpretation of these relationships was that instability in the technology and pervasiveness of physicians influenced both directly, and indirectly through their effect on subunit size, the extent to which professionally qualified nurses were employed in nursing subunits.

In order to more clearly understand the nature of the factors contributing to the tendency for some nursing subunits to increase the proportion of professionally qualified nurses employed, a review of the conceptualization and measurement of technological instability and pervasiveness of physicians is presented. It will be recalled that instability in the technology was operationalized by the unpredictability of patients' conditions, the frequency of nursing observation required by patients, the need for special tests and equipment, and the emergency nature of patient interventions. The degree of pervasiveness of physicians into the subunit was measured by the frequency of physicians' visits to the subunit, how long they stayed, the number of emergency telephone calls to physicians, and the frequency of cardiac arrests. It was not surprising that instability in the technology and the pervasiveness of physicians were found to be highly correlated.

It would seem relatively clear, therefore, that the strategy of increasing the proportion of professional nurses employed in some subunits was a result of a complex combination of factors associated with

the criticality of patients' conditions, the need for highly complex medical equipment, and the requirement for physicians to be actively involved in subunit activities. In such circumstances, the results implied that the number of beds (patients) located in the nursing subunit was relatively small.

It also appeared that the process of adaptation of nursing subunits to handle emergencies and instabilities took place at the level of the individual nursing subunit as opposed to the level of the total hospital. Some support for this notion was provided by the clearcut differences between the types of nursing subunits in terms of both the contingency variables of importance and the proportion of professional nurses employed.

As indicated in Chapter IV, intensive care units were significantly smaller than all other types of nursing subunits, had greater instability in technology, higher pervasiveness of physicians into the subunit and a higher proportion of professionally qualified nurses. Although the differences were less clearcut, auxiliary, rehabilitation, and rural subunits tended to be larger in size, have less instability in the technology, lower pervasiveness of medical staff, and a lower proportion of professional nurses.

A second indication that the adaptive process was a nursing subunit level phenomenon was provided by the importance of the fourth contingency associated with increases in the proportion of professional nurses employed; this contingency was the autonomy from nursing administration. This finding implied that nursing subunits with a high proportion of professional nurses tended to operate relatively independently from nursing administration in deciding budgets and

personnel requirements and for planning and evaluating patient care. This result was consistent with the suggestions by Thompson (1967) that subunits with highly complex technologies tend to operate relatively independently and isolated from the rest of the organization.

A third reason why, from the results of this study, it was suspected that increasing the professional component of the nursing staff was a subunit phenomenon as opposed to a hospital phenomenon was due to the general lack of importance of the measures of the secondary environment in predicting the R.N. ratio. Quite clearly, the stepwise regression analysis showed that the subunit characteristics of technology, size, and immediate environment were more important than the characteristics of the hospital in explaining variance in the R.N. ratio.

In conclusion, the results of this study implied that some nursing subunits tended to respond by increasing the proportion of professional nurses employed when they were faced by a combination of circumstances suggested by instabilities in the patients' conditions needing high involvement of physicians in patient care. These situations tended to occur in small subunits where there was considerable autonomy from administration. Overall, the adaptation of nursing subunits by increasing the professional nurses employed did not appear to be a direct result of the characteristics of the hospital as a whole (teaching status, size, structural differentiation or community size) or because of the interactions of the nursing subunit with other groups and departments in the hospitals.

In general, these findings were consistent with the research of

Comstock and Scott (1977) which suggested that unpredictability in nursing tasks was associated with increases in the R.N. ratio. The results were in keeping with the work of Heydebrand (1973) in hospitals and Hage and Aiken (1969) in health and welfare agencies which implied that larger numbers of professional workers tended to be employed when the work was less routine or more complex. The findings also supported the descriptions by Georgopoulos (1978) of the high interdependences created between physicians and nurses at the patient care level. Quite remarkably, from this study, it appeared that physicians and the requirements imposed by medical technology had considerable influence over the extent to which professional nurses were employed in nursing subunits. Etzioni (1969) suggested that nurses should be classified as semi-professionals because they do not make decisions of "life and death" and because they are accountable to physicians as opposed to being directly able to control their own practice. Some validity for these statements were provided from this research.

The importance of subunit size as a factor contributing to the extent to which professionally-educated nurses were employed was consistent with the research of Child (1973) for the total organization in business firms although Child found a positive relationship between organizational size and the level of specialist qualifications. In this current research, subunit size was found to be not only an important factor in determining the proportion of professional nurses employed in each subunit but also in determining the degree of bureaucratization of professional nurses when this was measured by the proportion of the professional nurses employed in leadership positions.

Contingencies Associated with Increases in Decentralization in Decision-Making

The contingencies associated with the tendency to increase the degree of decentralization in decision-making, as identified from the stepwise analysis, are illustrated by two separate models: the first, concerning decentralization from the headnurse; and the second, relating to decentralization from physicians.

Decentralization from the Headnurse

The contingencies associated with increases in decentralization in decision-making from the headnurse are illustrated in Figure 2. These variables accounted for approximately 34 percent of the variance in decentralization in decision-making from the headnurse. In general, the findings indicated that the extent of decentralization from the headnurse within nursing subunits depended upon: a) the technology; b) the extent to which professional nursing staff were available for patient care; and c) the relationship with physicians in the immediate environment.

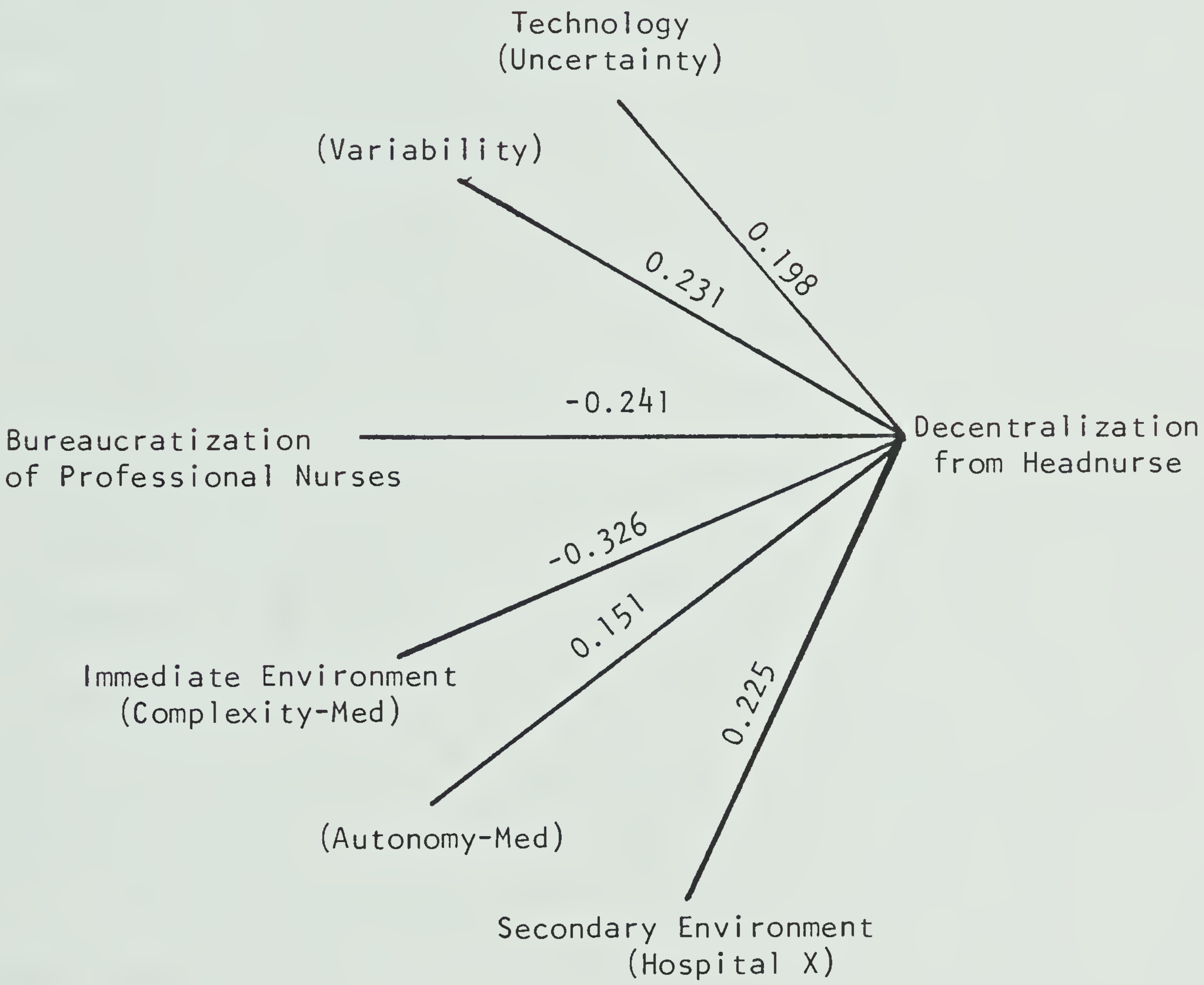
First, in terms of the technology, the results showed that there was a greater tendency for headnurses to decentralize decision-making to other nurses within the subunit when the technology was uncertain and variable.

Although uncertainty in technology is shown in Figure 2 to have a relatively low regression coefficient, in the stepwise analysis it appeared as the contingency variable explaining the largest proportion of variance in decentralization from the headnurse. It will be recalled that technological uncertainty was operationalized by the degree to which nurses' work involved patients who presented complex

Figure 2

Contingencies Associated with Increases in Decentralization from the Headnurse

Standardized Regression Coefficients[a]



[a]Variables of importance and standardized regression coefficients derived from stepwise regression presented in Chapter VI.

social-psychological problems. The nursing care for these patients was viewed as being adapted to the individual patient's condition or mood and relied mainly upon nurses' intuition for designing appropriate interventions. The uncertainty in the technology was seen as being derived from the general lack of adequate knowledge base concerning the nature of patients' social-psychological states and the lack of validated techniques for helping or resolving patients' problems. This area of nursing work has been referred to as the independent functions of the nurse and a strong argument has frequently been presented in the nursing literature that such functions are the "true" professional elements of nursing (Mauksch, 1966).

In addition to uncertainty in the technology as a factor contributing to the extent of decentralization in decision-making from the headnurse, variability in the technology was important. It was suspected that the variability in the work may have been perceived by the nurses because of the individualized nature of patients' problems and for this reason the headnurse more appropriately delegated decision-making to nurses working directly with patients.

The findings indicated that headnurses were more likely to delegate decision-making to nursing staff under conditions of technological uncertainty and variability when there was a low level of bureaucratization of professional nurses. It will be recalled that (by definition of this variable) where there is low bureaucratization of professional nurses there is a greater proportion of professional nurses not employed in leadership positions and, therefore, available to give direct patient care. It would seem clear, therefore, from the analysis of variables influencing the headnurse's propensity to

decentralize decision-making that, the extent to which professional nurses were available to work directly with patients was an important factor. Presumably, the headnurse would see having a larger proportion of professional nurses available in clinical positions as one strategy to be used to overcome the gaps in knowledge about how to proceed in providing patient care where there was technological uncertainty (professional nurses because of prior professional socialization would have some general guidelines, if only ideologically based, for handling the uncertainty (Katz, 1969)). In addition, the headnurses might consider professional nurses working directly with individual patients to be in a more advantageous position than the headnurse for assessing patients' social-psychological states and for designing appropriate interventions.

Lack of complexity of physicians in the immediate environment and high autonomy from the subunit from physicians were also important factors contributing to the headnurses' tendency to decentralize decision-making. This finding suggested that headnurses tended to decentralize decision-making in subunits where the medical technology was highly specialized, such as, in intensive care units or psychiatric units. These results were further supported by the importance of hospital X in predicting the degree of decentralization from the headnurse. Hospital X is a teaching hospital with highly specialized medical technologies. In addition, hospital X also has a greater tendency to employ graduates from their own school of nursing (as opposed to employing graduates from other schools of nursing) which could have influenced the extent to which headnurses in the subunits in hospital X felt comfortable in decentralizing decision-making

within the subunits.

Further evidence of the notion that decentralization from the headnurse tended to occur in highly specialized circumstances was obtained from examining the factors of importance to the degree of bureaucratization of professional nurses (Table 36). Quite clearly, subunits with low bureaucratization of professional nurses tended to be located in the urban acute general hospitals (not chronic or psychiatric) and in hospitals with high structural differentiation.

In general, the contingencies associated with the degree of decentralization of decisions from the headnurse appeared to be handled at the level of the individual nurse but under the control of the headnurse. There were few clearcut differences between the types of nursing subunits either in terms of decentralization from the headnurse or technological uncertainty and variability; however, psychiatric units ranked relatively high on these variables which supported the social-psychological nature of patient care inherent in this trend.

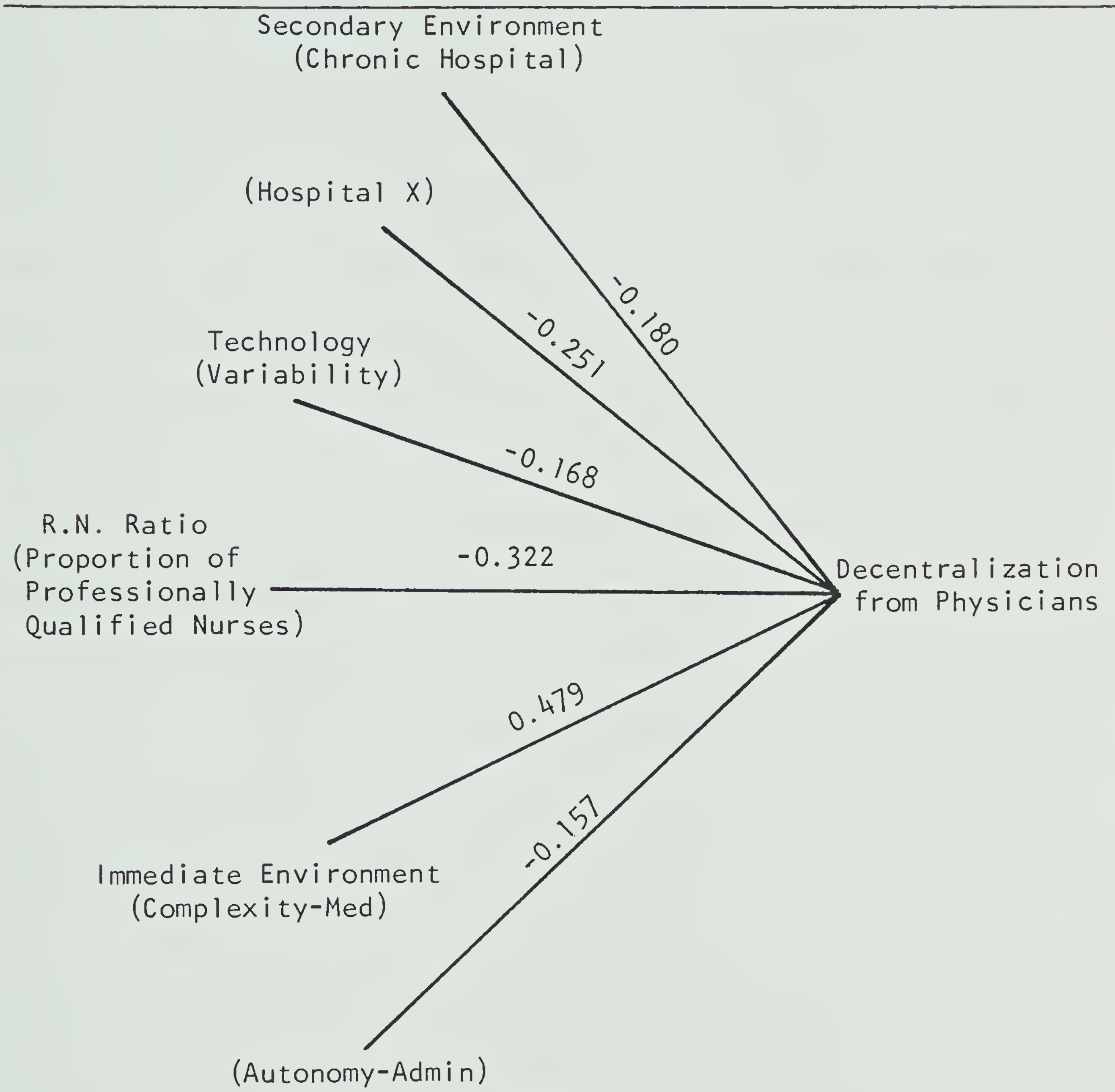
Decentralization from Physicians

The contingencies associated with decentralization from physicians are shown in Figure 3. About 37 percent of the variance in decentralization from physicians was explainable by the variables illustrated. The findings indicated that decentralization from physicians tended to occur when there was high complexity of physicians in the environment, that is, when there were large numbers of physicians allowed to admit patients to the subunit and when the physicians were of a variety of specialities. The picture presented by the factors associated with high decentralization of decision-making from

Figure 3

Contingencies Associated with Increases in Decentralization from Physicians

Standardized Regression Coefficients[a]



[a]Variables of importance and standardized regression coefficients derived from stepwise regression presented in Chapter VI.

physicians was not one of highly professionalized complex circumstances but, rather, the image is one of a relatively routine set of situations. For example, the results suggested that high decentralization of decision-making from physicians tended to occur when there was only a small proportion of nursing staff with professional qualifications and when there was little variability in the technology. In addition, in such circumstances, there was a tendency for nursing administration to have greater control over subunit activities as indicated by the negative relationship between subunit autonomy from administration and decentralization from physicians. It appeared quite clear from these results that such circumstances did not occur in subunits in hospital X, which were more likely to be characterized by low decentralization from physicians, nor in the subunits located in the one chronic hospital in the study.

The types of nursing subunits ranking high in terms of decentralization from physicians, complexity of physicians, and variability in the technology were not clearcut but, overall, there was a tendency for auxiliary, medical, rehabilitation, and pediatric subunits to rank higher than others. These findings provided some support for the argument that factors contributing to decision-making independently from physicians were those concerned with more routine or general types of patients and circumstances. Neither high nor low decentralization from physicians could, however, be linked with a specific type of nursing subunit or speciality.

In conclusion, decentralization in decision-making tended to occur as a result of two different patterns of circumstances. Decentralization from the headnurse to nursing staff within the subunit

was observed where there was considerable uncertainty in the technology and where there was a greater proportion of professional nurses available to give direct patient care. The uncertainty in the technology was associated with the social-psychological problems presented by patients and the general lack of knowledge for how social-psychological problems should be handled. In such circumstances, the strategy for handling uncertainty was by delegation of decision-making to individual nurses working with patients assuming that prior professional socialization would provide guidelines for deciding appropriate nursing actions.

Decentralization from physicians tended to occur in relatively routine non-critical circumstances. Here, greater control of subunit activities was maintained by nursing administration and there was a tendency for fewer professional nurses to be employed in nursing subunits.

Subunit size, the characteristics of the secondary environment as a whole and the need for interaction with other groups and departments in the hospital were not shown to be important for either type of decentralization.

Contingencies Associated with Increases in Written Documentation

The pattern of contingencies found to be associated with increases in the types of written documents available to nurses within nursing subunits are shown in Figure 4; these variables accounted for approximately 43 percent of the variance in role definition. The results of this study implied that formalization by role definition, when measured by the number of written documents, was primarily influenced by the characteristics of the hospital as a whole rather than

by characteristics of the nursing subunit. Where there was a large number of written documents available to nursing staff, the subunits tended to be located in small hospitals and in hospitals with greater structural differentiation. In contrast, subunits with a smaller number of written documents were more likely to be located in large hospitals and those with a lesser degree of structural differentiation. Larger hospitals and those with teaching status also tended to allocate a larger proportion of the subunit staff to clerical work. The proportion of staff employed for clerical work, in turn, was associated with increases in the number of written documents available in the subunit. There was also a tendency for nursing subunits with greater autonomy from administration to allocate larger proportions of the staff to clerical work. One possible interpretation of this latter finding was that the use of standardized written documents was a method of achieving some degree of bureaucratic control over subunit activities when subunits tended to operate relatively autonomously.

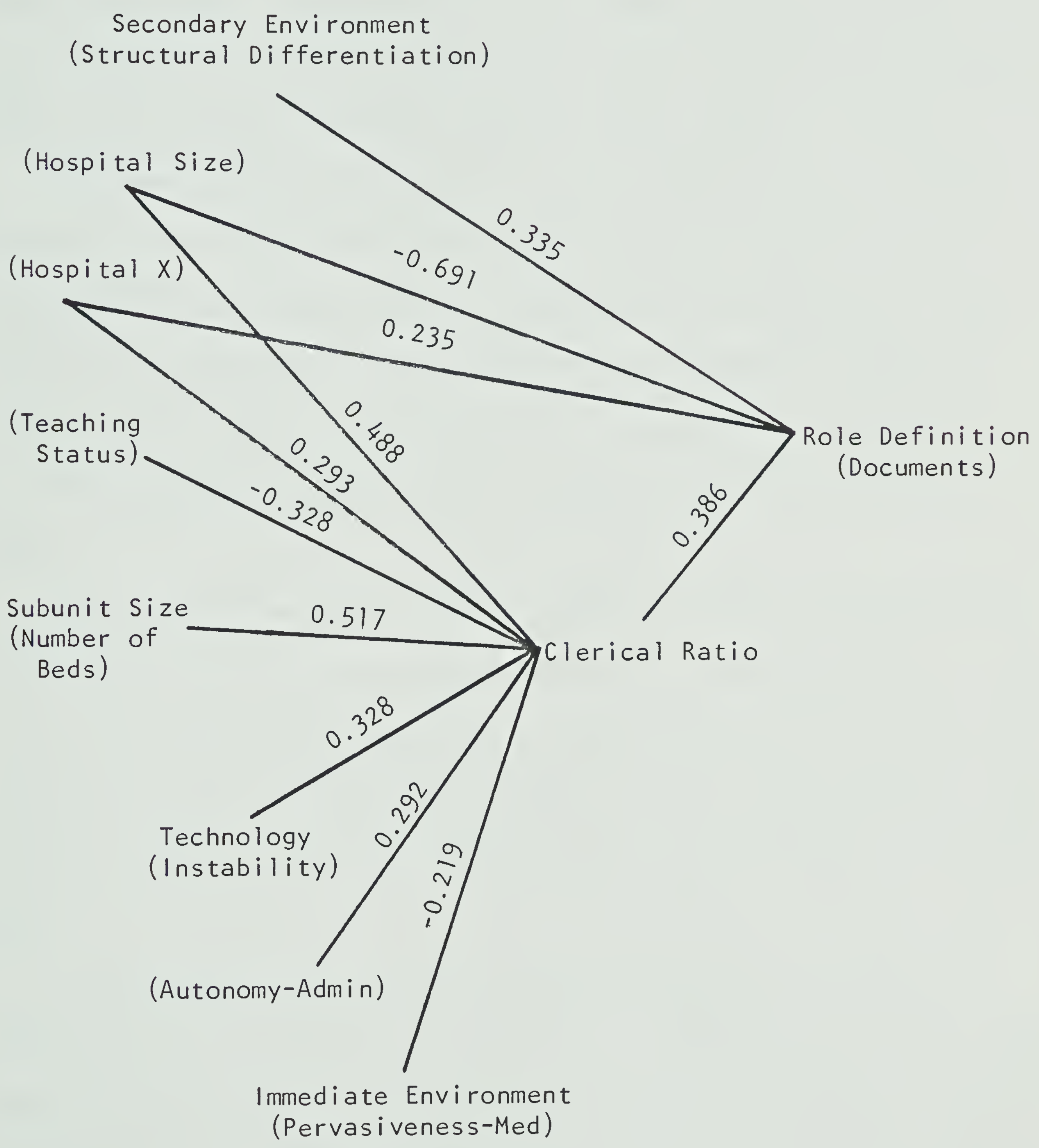
It seemed relatively clear from this analysis that the subunits in hospital X had a greater amount of documentation and a higher clerical ratio than subunits in other hospitals in the study. It is suspected that the relative newness of hospital X may have provided the administration of the hospital with the opportunity to introduce a greater number of subunit documents and the higher level of clerical assistance.

Support for the notion that formalization by role definition was the result of policies which were standardized throughout the hospital as opposed to being differentiated by subunit was provided by the

Figure 4

Contingencies Associated with Increases in Written Documentation

Standardized Regression Coefficients[a]



[a]Variables of importance and standardized regression coefficients derived from stepwise regression presented in Chapter VI.

results of the analysis of variance by type of subunit presented in Chapter IV. No significant differences were found between the nine types of nursing subunits in terms of their degree of role definition or their degree of autonomy from administration. The differences between the types of nursing subunits in terms of the proportion of staff allocated to clerical work were minimal; although auxiliary and rural units appeared somewhat lower than other types of subunits.

The contingencies associated with the degree of documentation were not those concerned with the technology of the subunit, nor the complexity of physicians and other groups and departments interacting with the subunit. The clerical ratio appeared to be weakly related to the degree of pervasiveness of physicians and instability in the technology but the impact of these variables was relatively small.

The size of the subunit was an important factor for determining the clerical ratio of the subunit. It will be recalled, however, that the relationship between subunit size and the clerical ratio was nonlinear; small and large subunits tended to have a small clerical ratio and the largest clerical ratio being observed for subunits of about 38 beds.

In conclusion, the pattern of contingencies influencing the amount of written documentation in nursing subunits was consistent with the findings of research conducted at the level of total organization. For example, Child (1973) suggested that the extent of documentation was a result of the size of the total organization as well as the degree of specialization of roles within the organization. The results of this current study implied that the individual hospital context in

which the subunit was located was probably the most important factor for influencing the number and types of written documents available in nursing subunits.

Conclusions

The previous discussion has attempted to illustrate how the nursing subunits in this study appeared to make structural accommodations in accordance with the types of contingencies they face. Since the main aim of this research was exploratory, that is, to explore the relationships between the contingencies of technology, size and environment with structure no definitive conclusions could be drawn concerning the nature of causal relationships between the various contingencies and subunit structure. It was possible, however, to identify three main trends in the types of structural responses made by nursing subunits and to describe specific contingencies associated with these responses.

It was quite clear from this research that technology, size and environment did not operate independently in their interactions with subunit structure. In keeping with the types of patterns which could be expected from the real world of nursing subunits elements of the environment, elements of technology and size tended to combine and jointly influence the form of the subunit structure.

The importance of technology as a factor influencing structure has been described and empirically delineated in different types of human service organizations (see for example: Hage and Aiken, 1969) including nursing subunits (Comstock and Scott, 1977). This current research not only indicated that technology was linearly related to

subunit structure but also that it was important to consider the specific conceptualization and operationalization of technology. For example, instability in the technology was found to combine with subunit size and the pervasiveness of medical staff to influence the extent to which professionally qualified nurses were employed in nursing subunits. Uncertainty in the technology combined with the complexity of physicians in the environment and the proportion of professional nurses employed to interact with the extent of decentralization in decisions from the headnurse. Variability in the technology was an important factor associated with decentralization of decisions from the physicians.

Subunit size, when considered alone, was found to be highly, linearly related with two measures of structural complexity; these were the R.N. ratio and the degree of bureaucratization of professional nurses. The importance of organizational size for determining structural complexity had been outlined by Child (1973); this research in nursing subunits, however, suggested a negative relationship between subunit size and the two measures of structural complexity. In addition, subunit size was found to be nonlinearly related to the clerical ratio, the third measure of structural complexity in this study. Both small and large subunits tended to have low clerical ratios, whereas, subunits of medium size tended to have high clerical ratios. Subunit size was not found to be an important factor in the degree of decentralization which was, therefore, inconsistent with the research of Child (1973).

The secondary environment of the nursing subunit, operationalized

in terms of characteristics of the hospitals as a whole, emerged as important factors relating to the extent to which written documents were available in nursing subunits. Hospital size, teaching status and structural differentiation combined with a measure of the clerical component of the staff of nursing subunits to influence the extent to which written documents were available. These findings were generally consistent with the research (see for example: Pugh, Hickson, Hinings and Turner, 1969) which has attempted to examine the relationships between organization context and structure.

It also became apparent during this study that the type of hospital, for example, whether the hospital specialized in the care and treatment of chronically ill patients or mentally ill patients or whether the hospital was located in a small community had important implications for the type of nursing subunit structure. Although the influences of these hospital variables could not be extensively investigated because of the lack of systematic sampling of hospitals for the study, there was some indication that subunits located in chronic or psychiatric hospitals tended to have greater bureaucratization of professional nurses and different patterns of decision-making behavior. In addition, it was found that the characteristics of one individual hospital, such as hospital X in this study, could produce a relative unique subunit structural form. The full extent of subunit structural differences by individual hospital could not be explored within the resources of this study; however, the results implied that individual hospitals (and their administrators) have the potential flexibility for making individual decisions and develop strategies for handling their contingencies as they perceive them.

The immediate environment of the nursing subunit was measured in terms of the degree of complexity and pervasiveness of physicians and other groups and departments interacting with the subunit and in terms of the degree of subunit autonomy from physicians and nursing administration. The results of this research illustrated the significance of physicians in the day to day operation of nursing subunits which was in keeping with the descriptions of Georgopoulos (1978). For example, the degree of pervasiveness of physicians into the subunit was an important factor associated with subunit size and with the extent to which professional nurses were employed. The complexity or heterogeneity of physicians interacting with the subunit combined with the type of technology and the proportion of professional nurses employed in influencing the decision-making behavior within the nursing subunit. The complexity and pervasiveness of paramedical, clinical and hotel services did not, however, emerge as important factors in determining nursing subunit structure.

Autonomy from administration was shown to be a significant factor associated with both structural complexity and the extent of decentralization from physicians although autonomy of the subunit from physicians was, in general, rather significant in influencing subunit structure.

Overall, environment complexity and pervasiveness and subunit autonomy did not show strong relationships with subunit structure when examined individually which was disappointing given the emphasis placed on these variables in the literature on organization-environment relationships; however, when the measures of environment were considered in conjunction with technology and size, their contributions

to explaining variance in subunit structure became more clearly apparent.

One of the most interesting results implied by the assessment of the relative importance of the contingency variables was concerned with the possibility that responses to various combinations of contingencies may take place at different levels within organizations. Although the findings were not clearcut, encouraging support was provided for the possibility that different responses may occur at the hospital level, the nursing subunit level, and individual nurse level. For example, it was implied that a response of increasing written documentation was a reaction of the hospital as a whole as opposed to a reaction of individual nursing subunits. Responses to technological instability and the requirements of medical technology by designing small subunits and increasing the number of professional nurses appeared to be adaptive processes at the subunit level of analysis because of the clear differences between the types of nursing subunits on these variables. The responses to uncertainty in the technology tended to be handled at the level of the individual nurse working with patients, especially when sufficient professionally qualified nurses were employed.

The idea that responses to contingencies might take place at different levels within hospitals makes sense from a practical viewpoint given the multiple authorities to which nursing subunits are in some way accountable. As indicated in Chapter I and as described by Georgopoulos (1978) nursing subunits are accountable to three different authority systems. First, under the control of the headnurse,

nursing subunits are responsible to the total hospital bureaucracy since nurses are formally employed by the hospital organization. Second, the nurses are directly accountable to physicians for the assistance they provide in administering patients' treatments and care. This authority system for nurses is different from the authority system of the hospital bureaucracy as a whole since physicians are not usually employees of the hospital. Third, the nurses have some accountability as individual members to their professional associations. Although this accountability of nurses to a professional body may not be as pronounced as amongst other professional groups, such as physicians, the nurses themselves and the hospital as a whole rely upon the nursing profession's ideology and code of ethics to guide nurses in day to day nursing practice.

Limitations

Some of the limitations of this research stemmed from the elementary stage of development of the contingency approach to organizational analysis. As indicated in Chapter I, the main limitations associated with the contingency model, to date, have been: 1) the lack of precision in defining the nature of causal relationships within the model; 2) an absence of comprehensiveness in the contingency variables included in the model; and 3) little empirical substantiation for the supposition that organizations which are appropriately structured for their contingencies will be more effective. This research did not set out to specifically test causal relationships between subunit contingencies and structure although the results suggested some potential theoretical clarification of the relationships. The study included

14 measures of contingencies yet it is possible that there may be other more important factors not measured in this research which could influence nursing subunit structures. Examples of such contingencies are the possible effects of government controls on the complexity of the structure and the potential influence of professional organizations on nursing behaviors. This research did not attempt to take into consideration any possible evaluation of the effectiveness of nursing subunits as an outcome of the match between structure and contingencies.

There were several notable limitations to the methodology employed. The sampling plan for including subunits in the study was made on the basis of voluntary participation of the hospitals. No attempt was made to randomly select hospitals, subunits or nurses for the study since this technique was judged to impose upon the prerogatives of the nursing administrators given the amount of voluntary time all levels of staff were required to spend providing the data. Quite clearly, the lack of controlled sampling of hospitals produced some limitations in terms of the analysis which could be performed to investigate the importance of hospital type.

The development of measures of nursing subunit structure, technology, size, and environment formed a large part of this research since there were few instruments from previous research which had been validated for nursing subunits. Alpha reliability coefficients were employed as indicators of the homogeneity of items being combined to form composite scores. For some of the measures of the immediate environment the Alpha coefficients were not high. Analysis of variance was used to examine if there were differences between the nine types

of nursing subunits in terms of the main measures. Where differences found were in keeping with practical experience the measures were assumed to be of acceptable validity. In some instances, however, differences were not found between the types of subunits or the differences were not clearcut.

The data were obtained from different sources within the nursing department of the hospital and each level could have been susceptible to its own biases. Much information was based upon nurses' perceptions of their work and their work circumstances. Although some researchers have suggested that perceptual data are important for obtaining true measures of technology and environment, the reliability of this information may be questionable.

One of the strengths of the methodology was the consistent use of the unit of analysis at the subunit level; this, however, may have produced some limitations. It was necessary for some variables to aggregate individual nurse scores to form subunit scores or to generate subunit scores from hospital data; this latter procedure resulted in up to 40 subunits being given the same score on a hospital variable. In both the aggregation and generation procedures, systematic biases may have been unintentionally introduced.

Much of the statistical analysis required some assumptions about the normality of distribution of variance in the population and about the nature of linear relationships amongst the variables. Given the general exploratory nature of this research some of these assumptions may not have been justified. In addition, stepwise regression analysis required that the independent variables <u>not</u> be highly correlated. Some moderate relationships were found amongst the independent varia-

bles and these may have made the resulting order of importance of contingency variables somewhat unreliable.

Overall, given the limitations of this research, some cautions are required in the generalizability of the findings of this study to the population of nursing subunits in hospitals in Alberta.

Further Research

Perhaps some of the most interesting questions raised by the findings presented from this study have to do with the next stages of research in this area.

The theoretical framework and hypothesized relationships received respectable statistical support although not all patterns of relationships between contingencies and structural adaptations were clear. Much further work is yet required in order to more precisely define the nature of causal relationships within the contingency model. This type of research could best be achieved through longitudinal studies where causal patterns could be observed through several time periods. Even a replication of the current study measuring the key variables outlined in Figures 1, 2 and 3 in Chapter VII could potentially contribute to the understanding of the directions of causation amongst the variables. The use of path analysis has been suggested by a number of authors, such as Shortell (1977), as a possible technique for clarifying causal relationships. It would also be worthwhile to empirically compare the contingencies found to be of importance in nursing subunits with those of other types of human service organizations. If the same measures were employed for both nursing and other human service groups then comparison of results would be facilitated.

Some differences were noted between the pattern of relationships identified in this study at the subunit level within organizations and those found by other researchers at the level of the total organization. Further research should be designed to more systematically identify similarities and differences in contingency effects at the level of the total organization and at the subunit level. In addition, it would be of value to include in such research the possibility of examining contingency influences at the level of the individual worker in the organization. In this manner, it would be possible to more precisely define the influences of professional levels of education upon workers' behavior.

On an exploratory basis, this study conceptualized and measured subunit environment at two levels: the secondary and immediate environment levels. It would seem clear from this research that this approach to levels of environment offers considerable potential; however, further empirical studies are needed to explore the number of levels, distances between them, and how these may be measured.

This study suggested that there were some important relationships between nursing and medical technology and nursing and medical decision-making behavior at the subunit level within hospitals. There does not appear to have been any previous research using Perrow's (1967) concept of technology for describing physicians' work yet it would seem to be an appropriate approach. An interesting further research study would be to compare nursing and medical technologies and decision-making behavior at the subunit level within hospitals.

In the long term, research in nursing subunits should be designed

to incorporate an evaluation of the level of effectiveness as a potential outcome of matching structure with contingencies. It is suspected, however, that it will be some time before the problems of validly measuring effectiveness in nursing subunits are overcome. Such research, however, has the greatest possibility for providing information which could contribute to the design of nursing subunits.

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APPENDIX I

QUESTIONS USED IN THE MEASUREMENT OF VARIABLES

QUESTIONS USED IN MEASUREMENT OF VARIABLES

The questions have been ordered according to the discussion in Chapter IV. First, the measurement of structure is presented. Second, the questions used for technology have been listed. Third, the questions on subunit size have been outlined. Finally, the items used for the measurement of subunit environment have been presented. For each variable the sources of the data have been indicated and, where applicable, the methods of scoring each item.

Structure

Complexity

Source: Nursing administrators of each hospital.

Method: Structured interview.

Instructions: Please provide the following information for each of the nursing units included in the study.

1. Number of R.N.'s (or above qualifications).
2. Number of C.N.A.'s and nursing orderlies (Registered Nursing Assistants).
3. Number of nursing assistants (ward aides).
4. Number of clerical staff (including ward clerks, secretaries, and/or unit managers).
5. Number of leadership positions (including headnurse, assistant headnurse, permanent team leader and any other leadership position title).
6. Total number of nursing positions allocated to each nursing unit (number of FTES).

Formalization - Role Definition

Source: Nursing administrators of each hospital.

Method: Check list provided during a structured interview.

Instructions: Please provide the following information for each of the nursing units included in the study.

Which of the following written documents are available for each nursing unit: A check (√) indicates "yes".

7a) contract of employment
b) information booklet about the unit
c) hospital organization chart
d) hospital orientation (written handouts)
e) unit orientation (written handouts)
f) nursing procedure manual
g) special procedure manual
h) hospital policy manual

i) nursing policy manual
j) special policies for the unit
k) instruction/guidelines for shift work
l) condition sheets
m) kardex
n) position descriptions for R.N.s
o) position descriptions for C.N.A.s
p) position descriptions for nursing orderlies
q) position description for headnurse
r) position description for assistant headnurse
s) position description for team leader
t) position descriptions for ward aides
u) position descriptions for clerical staff
v) position descriptions - other available? please specify.

Formalization - Role Specificity

Source: Nurses within each subunit.

Method: Questionnaire.

Instructions: Beside each of the statements listed below please indicate whether you strongly agree, agree, disagree or strongly disagree.

23. On this unit, nurses have a great deal of freedom and few rules to follow. (strongly agree scores 1).

26. Most nurses on your unit follow their own ideas in implementing nursing care. (strongly agree scores 1).

28. No matter what situation arises on this unit, we have procedures to follow in dealing with it. (strongly disagree scores 1).

30. On this unit, there are clear lines of reporting and authority. (strongly disagree scores 1).

31. There are very precise definitions of nurses' duties on this unit. (strongly disagree scores 1).

32. Responsibilities and authority are emphasized on this unit. (strongly disagree scores 1).

Decentralization

Source: Nurses within each subunit.

Method: Questionnaire.

Instructions: Beside each of the statements listed below please indicate whether you strongly agree, agree, disagree or strongly disagree.

Decentralization from Physicians

24. Even small matters about patients have to be referred to a physician for final decision. (strongly agree scores 1).

25. Nurses on this unit have a great deal of freedom in deciding nursing interventions for patients without asking physicians. (strongly disagree scores 1).

27. There can be little nursing action taken on this unit until a physician writes an order (strongly agree scores 1).

Decentralization from the Headnurse

33. Nurses frequently participate in decisions regarding what nursing care will be given to individual patients on this unit. (strongly disagree scores 1).

34. Nurses frequently participate in decisions to change or adopt new nursing techniques on this unit. (strongly disagree scores 1).

35. There can be little action taken on this unit until the headnurse approves the decision. (strongly agree scores 1).

36. Even small matters about patients have to be referred to the headnurse for a final decision. (strongly agree scores 1).

37. Nurses have to ask the headnurse before doing almost anything. (strongly agree scores 1).

Technology

Source: Nurses within each subunit.

Method: Questionnaire.

Instructions: Beside each of the statements listed below, please indicate by checking (√) the answer which most closely represents your opinion. In all questions you are asked to estimate a percentage (0-5%, 6-25%, 26-50%, 51-75% or 76-100%). (Low percentage scores 1).

Uncertainty

3. For some patients more than others it is important to know complete details of their previous health history. For what percentage of the patients on your unit is it critical that the nurse know a detailed history from birth to present time?

4. What percentage of the patients on your unit has complex problems that are not well-understood?

9. What percentage of the time does improvement in patients' conditions really have to depend upon the skillful work and initiative of nursing personnel?

10. What percentage of your work requires the analysis of complex problems?

11. What percentage of the patients have written goals for their individualized care in the Kardex (nursing care plan)?

12. What percentage of the nursing care on your unit is directed at meeting patients' socio-psychological needs (as opposed to physical needs)?

13. What percentage of the nursing care given relies upon nurses' intuition rather than on set procedures or routines?

16. What percentage of new nurses starting work on your unit would find the nursing care speciality difficult to learn?

17. What percentage of your work changes in direct response to changes in patients' conditions or moods?

18. What percentage of the time are you highly dependent upon other nurses on your unit for help and/or are they dependent upon your help?

<u>Instability</u>

1. In your estimation, what percentage of patients on your unit needs nursing observation more often than once every half hour?

5. What percentage of the nurses' work involves performing technical procedures and special tests?

6. What percentage of patients require the use of technical equipment (i.e. suctions, cardiac monitors, respirators, etc.).

7. What percentage of the patients on your unit on an average day require an intravenous infusion?

8. On some units there is greater pressure to give nursing care quickly because of patients' critical conditions. What percentage of the time is there a greater time pressure on your unit?

19. In your estimation, what percentage of the decisions made by the nursing staff of your unit are made independently from physicians?

Instructions: The nurses were asked to indicate whether they strongly agree, agree, disagree, or strongly disagree with the following two questions.

20. Nurses on your unit have frequent verbal or written communication with medical staff. (strongly disagree scores 1).

21. On this unit, there are many emergencies when immediate nursing action must be taken in response to changes in patients' conditions. (strongly disagree scores 1).

<u>Instability</u>

Source: Headnurse within each subunit.

Method: Questionnaire.

Instructions: Please indicate the types of equipment which are used regularly for patients on your unit (low complexity scores 1; high complexity scores 4).

107. (4) heart monitors, ventilators
(4) dialysis equipment
(3) I.V. equipment
(4) suction equipment (e.g. gastric tracheal, wound)
(4) oxygen equipment, continuous pipeline
(2) oxygen equipment, portable
(3) special physiotherapy equipment (e.g. hot wax baths, whirlpool tub)
(3) prosthetic applicances
(2) medication equipment (e.g. syringes)
(3) special body lifts
(3) special beds
(3) special body frames
(3) parallel bars
(1) wheelchair, stretcher
(1) walker, canes, crutches
(1) commode
(1) security room
(1) restraints
(1) handrails, ramps

Variability

2. What percentage of the patients would you say have similar health problems (or diagnosis)? (high percentage scores 1).

14. What percentage of the nursing care procedures are similar for most of the patients on your unit? (high percentage scores 1).

15. What percentage of the decisions made by nurses during their work are repetitive from one day to the next? (high percentage cores 1).

Size

Source: Nursing administrators of each hospital.

Method: Structured interview.

Instructions: Please provide the following information for each of the nursing units in the study.

1. How many beds are located on each nursing unit?

Environment

Secondary Environment

Source: Canadian Hospital Directory, 1977.

Data obtained for each hospital:

1. Number of hospital beds
2. Teaching status
3. Number of positions listed as "director" .

Source: Census of Canada, Statistics Canada, 1971.

1. Community size in terms of number in population converted to a three point scale:
   1. small communities - less than 7,000 persons
   2. intermediate communities - 11,000 to 50,000 persons
   3. large communities - greater than 400,000 persons .

Immediate Environment

Source: Headnurse within each subunit.

Method: Questionnaire.

Instructions: Please provide us with your opinions by checking (√) the response which most closely represents your view. (Responses available for questions 70, 60-69 were: never, seldom, sometimes, often, always). (never scores 1).

Autonomy from Physicians

70. How frequently are decisions made by nursing staff of your unit independently from physicians?

(Responses available for items 71 to 74 were: strongly disagree, disagree, agree, strongly agree.)

71. There can be little nursing action taken on this unit until a physician writes an order. (strongly agree scores 1).

72. If the nursing staff want to make their own decisions about nursing care they are quickly discouraged here. (strongly agree scores 1).

73. Even small matters about patients have to be referred to a physician for a final decision. (strongly agree scores 1).

74. Nurses on this unit have a great deal of freedom in deciding nursing interventions for patients without asking physicians. (strongly disagree scores 1).

Autonomy from Nursing Administration

60. How frequently do you make decisions to determine the nursing budget for your unit?

61. How frequently do you make decisions regarding hiring nursing staff for your unit?

62. How frequently do you make decisions regarding firing nursing staff of your unit?

63. How frequently do you make decisions regarding evaluation of nursing care?

64. How frequently do you make decisions regarding planning and organizing the nursing unit on a day-to-day basis?

65. How frequently do you make decisions regarding long-range plans for the nursing unit?

66. How frequently do you usually make decisions on the promotion of nursing staff of your unit?

67. How frequently do you make decisions on the adoption of new nursing policies for your unit?

68. How frequently do you make decisions on the adoption of new nursing care programs (e.g. audit, patient classification, etc.) on your unit?

69. How frequently do you make decisions about nursing students (e.g. number on your unit, learning experiences, patient assignments) on your unit?

Medical Complexity

12. How many physicians have admitting privileges to your unit? (Circle one)

    1 2 3 4 5 6 7 8 9 10 more than 10

13. How many different specialities are included in your unit (e.g. medical, surgical, ENT, obstetrical, psychiatric)? (Circle one)

    1 2 3 4 5 6 7 8 9 10 more than 10

Other Complexity

18. Which of the following paramedical services are frequently used on your unit? (Check more than one if necessary.)

____ psychological services (e.g. testing)

____ leisure activity services (e.g. hobby training, friendly visiting)

____ social work services (e.g. counselling, financial assistance)

____ vocational services (e.g. sheltered workshops)

____ information about community services (e.g. home care services)

____ dietary counselling services

____ physiotherapy

____ speech therapy

____ respiratory therapy

____ orthotic services

____ foot care services

____ chaplaincy services

____ family therapy

____ occupational therapy

____ audiology services

____ prosthetic services

____ dental services

____ other; specify ____________________

22. Which of the following services does your unit have regular contact with? (Check more than one if necessary.)

____ Operating Room

____ Emergency Department

____ Ambulatory Care Department

____ Admitting Department

____ None

23. Which of the following units or stations does your unit have regular contact with? (Check more than one if necessary.)

____ Surgical unit

____ Intensive Care unit

____ Obstetrical unit

____ Pediatric unit

____ Rehabilitation unit

____ Auxiliary unit

____ Nursing Home unit

____ Psychiatric unit

____ Other; specify

____

____ None

Medical Pervasiveness

24. How frequently do phone calls go out from your nursing unit to physicians? (Check one)

____ many times a shift
____ 4 or 5 times a shift
____ about once a day
____ about once a week or less
____ about once a month or less

25. How frequently are stat. calls made from your unit to physicians? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

26. How frequently are cardiac arrest calls made from your unit? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

27. How frequently are medical consultations (referrals) made from your unit to physicians not part of your attending staff? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

28. What times of day are physicians on your unit? (Check one)

____ throughout the 24-hour period continuously
____ throughout the 24-hour period intermittently
____ day and evening shift continuously
____ day and evening shift intermittently
____ day shift mainly, but continuously
____ day shift mainly, but intermittently

29. On average, how long does an attending physician say on your unit when he visits? (Check one)

____ less than ½ hour
____ ½ to 1 hour
____ 1 to 2 hours
____ 2 to 4 hours
____ 4 to 8 hours
____ more than 8 hours

30. How frequently do attending physicians visit your unit? (Check one)

- ____ infrequently
- ____ about once a month
- ____ about once a week
- ____ about once a day
- ____ several times a day

31. When a physician makes rounds, who is usually with him? (Check more than one if necessary.)

- ____ He is usually alone
- ____ Headnurse and/or Team Coordinator
- ____ Other Registered Nurses
- ____ Other Health Personnel

34. For which reasons do attending physicians most frequently visit your unit? (Check one)

- ____ mainly for rounds
- ____ rounds and to give treatment
- ____ rounds and for emergencies
- ____ rounds, emergencies and treatments

<u>Other Pervasiveness</u>

36. On average, how frequently do paramedical personnel visit the unit? (Check one)

- ____ almost never
- ____ about once a month
- ____ about once a week
- ____ about once a day
- ____ several times a day

37. Relative to other units, how important are paramedical services to good patient care on your unit? (Check one)

- ____ less important
- ____ average important
- ____ more important

38. How frequently do you spend time talking with and helping paramedical personnel? (Check one)

- ____ almost never
- ____ about once a month
- ____ about once a week
- ____ about once a day
- ____ several times a day

39. How frequently do you spend time talking with a communicating the unit's needs to service departments? (Check one)

- ____ almost never
- ____ about once a month
- ____ about once a week
- ____ about once a day
- ____ several times a day

40. How frequently do you spend time arranging for X-rays and/or laboratory tests? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

41. How often does your immediate supervisor visit your unit? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

42. How frequently does your supervisor give you instructions or provide you with guidelines regarding nursing policies and procedures? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

43. How frequently does your supervisor give you instructions or provide you with guidelines regarding nursing care of patients? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

44. How frequently does your supervisor give you instructions or provide you with guidelines regarding education of nursing staff and/or student nurses? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

45. How frequently does your unit interact with an Emergency Department? (Check one)

____ almost never
____ about once a month
____ about once a week
____ about once a day
____ several times a day

46. How frequently does your unit interact with an Operating Room? (Check one)

____ almost never	____ about once a day
____ about once a month	____ several times a day
____ about once a week	

48. How frequently does your unit interact with the Admitting Office? (Check one)

____ almost never	____ about once a day
____ about once a month	____ several times a day
____ about once a week	